A COMPARATIVE STUDY OF THENAR FLAP WITH CROSS FINGER FLAP FOR FINGER TIP RESURFACING

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CERTIFICATE

This is to certify that this dissertation titled **" A COMPARATIVE STUDY OF THENAR FLAP WITH CROSS FINGER FLAP FOR FINGER TIP RESURFACING"** has been prepared by Dr.G.Ashok Swaminathan under my supervision and guidance at the Institute for Research and Rehabilitation of Hand and Department of Plastic Surgery, Goverment Stanley Medical College.,Chennai, during the Academic year 2011-2014 and is being submitted to The TamilNadu Dr.M.G.R.Medical University Chennai in partial fulfilment of the University regulation for the award of the Degree of Master of Chirurgie-(M.Ch Plastic Surgery Branch III) and his dissertation is a bonafide work.

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DECLARATION

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INTRODUCTION

Whenever we face an illness, the aching part of our body reminds and warns us. A healthy person would not really remember and feel his back, unlike a person with a herniated disk pain in the area, can barely stand up. With this approach, we realize that every organ in our body is valuable and important; trying to prove one is above the others would be absurd. Having said that,we could think of hands as of those organs that distinguish humans from other living beings. As we all know mobility is watch word for upper limb, hands are important for daily living for all human. No machine or Robot in the world can replace a sensate and mobile hand and fingers. The hand is second only to face in its representation in the somatic sensory cortex of the brain [1]. Together with the muscles of vocalization, the hand accounts for more than half of the entire primary motor cortex [2] .

Hands are important with all their vessels, nerves, tendons, joints, skin and subcutaneous fatty tissues. For co-ordinated interaction of our hands and fingers with each other, the most important movement is opposition. Healthy pulp are very important not only for the transaction of fingers with each other, but also for the transaction with objects all around us. Finger tip is very useful for fine prop receptive touch and tactile sensations. All finger tip injuries represent tip of the iceberg.Thus, when there is a fingertip injury, it is mostly

occult pulp injury. All fingertip injuries other than pulp injuries could easily heal, either by themselves or with our help.

Finger tip injuries are the most common injuries of the upper extremity injuries. It results in loss of pulp , tip of the finger and in some instances exposure of terminal phalanx and insertion of FDP tendon.

DEFINITION

Fingertip is defined as the structures distal to the distal interphalangeal joint. Any thing distal to the insertions of the flexor and extensor tendons at the base of the distal phalanx is also considered as finger tip.

Its exposed position gives the fingertip a significant cosmetic value but also places it at high risk for injury.

Other reasons for finger tip injury includes

- exposed part
- Hand uses the fingers as prodding agent
- Protective mechanism helps to cover the hand

Fingertip injuries can occur in any age groups. They can result from recreational or occupational causes. During daily routine activities and day today work the fingertips are exposed and may be injured accidentally.

Mode of injury includes

- Blunt injuries
- Crush injuries
- Slicing injuries
- Clean cut amputation
- Avulsion injuries

Fingertips are the eyes of hand providing delicate structures for improving pinch. Earlier hands were considered as eyes for human beings especially for the visually challenged and labourers. This special glabourous thick skin at the finger tip when damaged or injured , exact replacement in terms of quality and quantity may be difficult.

Fingertip consist of the rounded pulp with fibrous septae with good padding distally, and proximally has only thin subcutaneous tissue at the level of the insertion of deep flexor tendons. It is important to know the mechanism and mode of injury ,structural defect and and about any co-morbid conditions to take decision about further management. Donor areas should also be examined. Condition of the artery and nerves should be assessed and evaluated. Movement at the individual joints at MP,PIP,DIP are evaluated. Integrity of the tendons are also checked . X-rays are taken to rule out any bone problems, fractures and any associated injury and foreign bodies .

The terminal phalanx bon and tuft of the TPX are most commonly injured and fractured. Very small fractures of the terminal phalanx or tuft of the bone usually left untreated.. Repair of the nail bed , usually re-aligns and this repair of soft tissues also stabilizes these bone fragments. Open reduction and internal fixation using wires to hold the bone fragments and fracture segments in proper position. . All fingertip injuries other than pulp injuries could easily heal,either by themselves or with our help.

Most common type of injuries in our department

Children – Door crush and Cracker burst injuries

Women – Mixie injuries at home and Industrial accidents

Men – Industrial accidents, Assault injuries

MANAGEMENT OF FINGER TIP INJURIES

The objective in the management of soft-tissue injuries of the hand is to achieve primary wound healing. Primary wound healing minimizes the inflammatory reaction, scar formation, and joint stiffening. Surgical approaches include primary closure, skin grafts, flaps, and free tissue transfers. The choice of treatment is based on the patients age, sex,mechanism of injury, the size of the defect, location and status of the wound, and injuries to other parts of the hand, as well as the general health,co-morbid conditions and occupation[5].

The principles pertaining to the timing of soft-tissue replacement are the same as elsewhere in the body. Soft-tissue replacement is performed as early as feasible but not necessarily at the time of injury. Initial treatment may consist of wound debridement alone. Tissues of uncertain viability are retained and inspected for viability at a second procedure. Once loss is certain, the tissue is excised, discarded, and replaced before an inflammatory reaction or infection complicates the wound.

The hand itself is superior to other sites for selecting the donor site for several reasons because best is the tissue match, sensory recovery is superior, and care is facilitated because the wounds are in a single region requiring regional anaesthesia such as Axillary nerve Block or wrist block or finally the digital block . When distant donor sites are chosen, the results achieved for the injured hand must justify the disfigurement and potential problems at the donor site includes tissue match and sensory recovery.

The pulp of the finger is covered by skin which is very durable and has a thick epidermis. The glabrous skin of the fingertip is very suitable for functions like for pinch and grasp .

Aim is to provide stable, sensate skin of like nature and the various options available are

- Thenar
- Cross finger flap

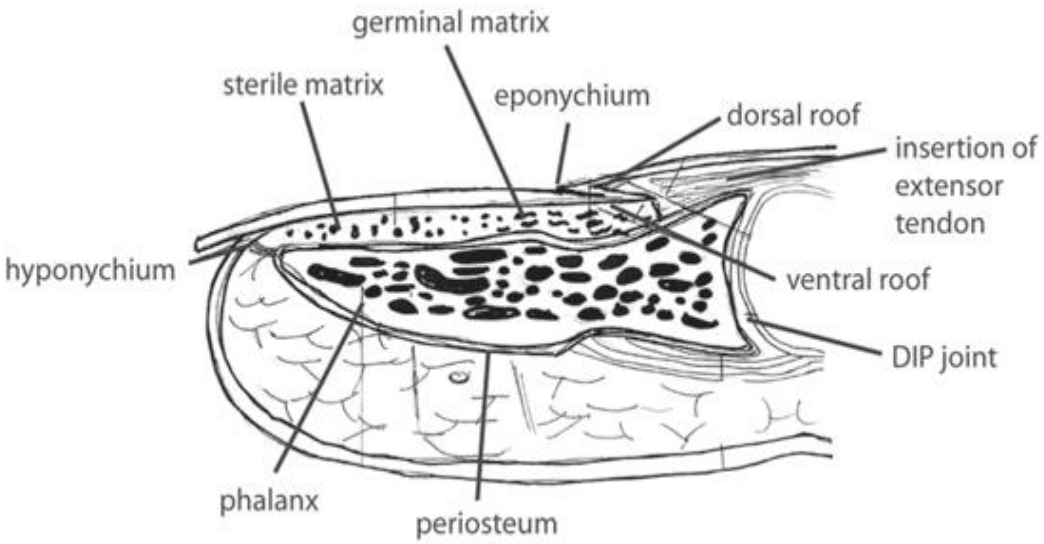
- Neurovascular island flaps
- Homodigital island flap and
- Small free flaps

AIM

1. To compare and study the functional and aesthetic outcome of finger tip injuries with skin loss which have been managed by thenar flap and cross finger flap.
2. To study the donor site morbidity in the above mentioned patients.

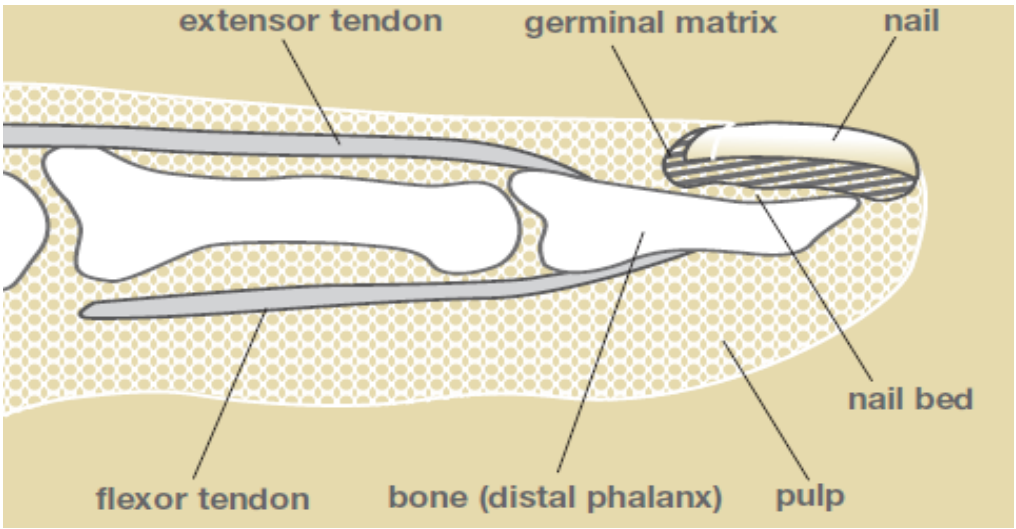
REVIEW OF LITERATURE

ANATOMY OF FINGERTIP

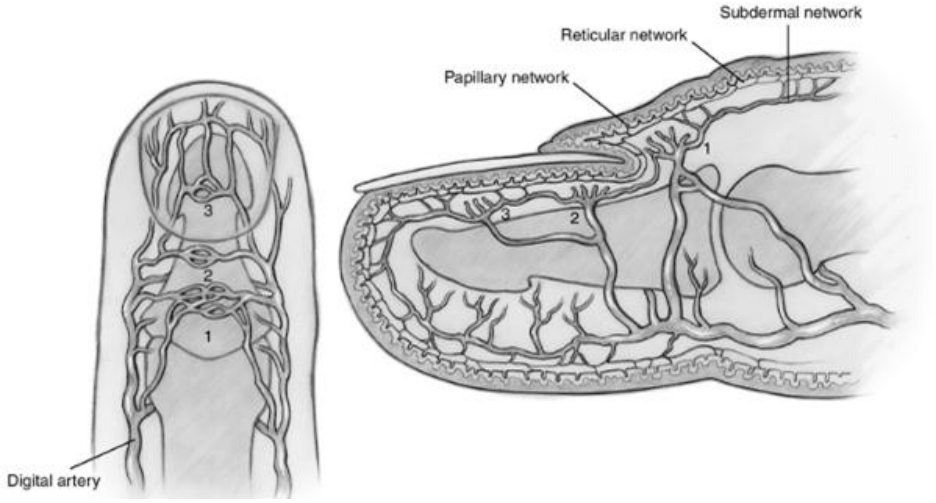


The glabrous skin of the fingertip is used for pinch and grasp functions. Its volar surface consists of a fatty pulp covered by highly innervated skin. The

skin of the fingertip is firmly anchored to the underlying terminal phalanx by multiple fibrous septa that traverse the fatty pulp The finger nail protects the fingertip and has a major role in tactile sensation and fine motor skills. The sterile matrix (ventral nail) contributes additional substance largely responsible for nail adherence. The roof of the nail fold (dorsal nail), which includes the germinal matrix, is responsible for the smooth, shiny surface of the nail plate. The hyponychium is the area immediately below the fingernail at its cut edge which serves as a barrier to subungual infection and also marks the terminal extension of bone support for the nail bed. The eponychium is the skin covering the dorsal roof of the nail fold. The paronychium is the skin at the nail margin, folded over its medial and lateral edges.



BLOOD SUPPLY OF FINGER TIP AND NAILBED



The arterial blood supply to the nail bed comes from two dorsal branches from the common palmar digital artery; the proximal vessel is a dorsal branch to the nail fold, and the second courses along the lateral nail plate margin and sends branches to the nail bed. These vessels anastomose dorsally with their counterparts to form arcades[7].

Branches from these vessels and the arcades form sinuses surrounded by muscle fibers, and help to regulate the blood pressure and blood supply to the extremities. These networks have been identified as papillary, reticular, and subdermal, and correspond to the general architecture of the vessels of the skin. The dermis of the nail bed is well vascularized, and includes large arteriovenous shunts (glomera). There is reduced vascular density in the region of the germinal matrix, in contrast to an increased vascular density in the sterile matrix. The comparatively less-vascularized germinal matrix demonstrates a

well-developed subdermal network located near a zone of loose connective tissue that is poorly vascularized near the proximal part of the distal phalanx. This zone may be a sliding apparatus between the nail and the distal attachment of the extensor tendon. A coalescence of veins in the skin, proximal to the nail fold, that course proximally in a random fashion over the dorsum of the digit, provides venous drainage. These veins are of sufficient size for microvascular anastomosis

NERVE SUPPLY

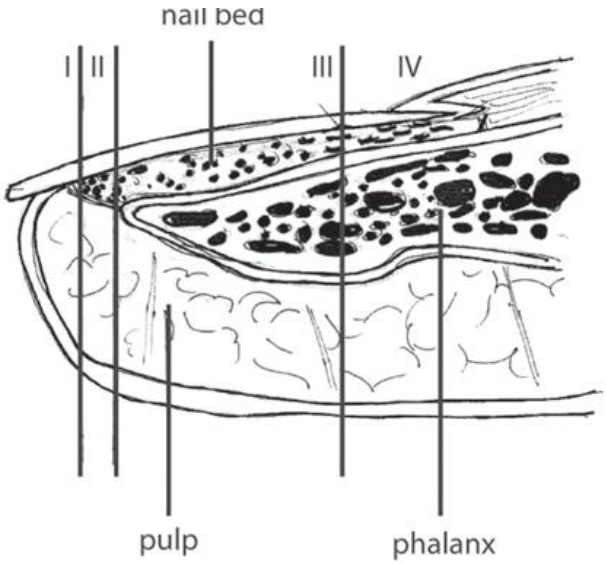
Branches from the paired digital nerves innervate the nail unit. The most common pattern (70%) is represented by a branch that passes beneath the nail plate and into the nail bed at approximately the level of the lunula and a second branch that passes distally to end at the hyponychial area. There are numerous sensory nerve endings, including Merkel discs and Meissner corpuscles[8]

INJURIES OF THE FINGERTIP

The fingertip is the most frequently injured part of the hand, and the middle finger is most vulnerable because it is the most distal and therefore the last to be withdrawn[9]. Sensation, maintenance of length, nail presevation, and cosmesis are important, as the primary aim of treatment is a fingertip with durable and sensate skin without pain. Considerable hand dysfunction results when a painful fingertip causes the patient to exclude the digit from use. The

specific wound characteristics determine which method of treatment is optimal for a given patient. In the case of amputations, it is important to establish the level and angle of injury.

CLASSIFICATION OF FINGERTIP INJURIES



Allen[10] has classified fingertip injuries based on the level of injury

- Type 1 injuries involve only the pulp
- Type 2 injuries involve the pulp and the nail bed
- Type 3 injuries include partial loss of the distal phalanx
- Type 4 injuries are proximal to the lunula

This classification is useful to help generate a treatment plan.

Treatment

Type 1 injuries may heal quite well by conservative management, especially in children.

In contrast, Types 3 and 4 often require some type of flap coverage.

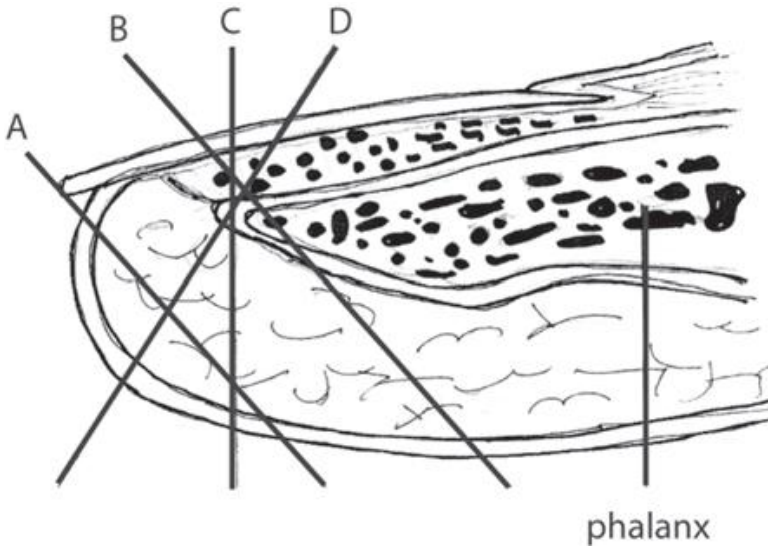
Additionally, tip amputations should be described in terms of the angle of injury—dorsal oblique, transverse, and volar oblique, as well as the presence of exposed bone

A – VOLAR OBLIQUE , BONE NOT EXPOSED

B – VOLAR OBLIQUE, BONE EXPOSED

C – TRANSEVERSE AMPUTATION

D - DORSAL OBLIQUE



Dorsal oblique and transverse injuries are more suited to local flaps[11].

Volar oblique injuries often require a regional flap.

HEALING BY SECONDARY INTENTION

Best and simplest treatment available for fingertip injuries is healing the by secondary intention[37]. It is reserved for small defects (8 to

10 mm^2), with minimal bone exposure and minimal loss of tissue pulp. Remove all infected and devitalised tissues and loose bone fragments.

Daily twice dressing the wound after proper irrigations.[12] Depending upon the size of the defect and other local factors the healing is achieved.. Children and elderly persons are well suited for the type of management. Wound healing is completed by 3-4 weeks.

Mennen[13] treated extensive fingertip defects with this method and reports excellent functional and cosmetic outcomes. The advantage of this treatment is that as the wound contracts, and pull the adjacent soft tissues and will cover the bone and defect.

However, if this same technique is used to treat more dorsal fingertip defects with involvement of the distal nail bed, the subsequent wound contraction can lead to "parrot-beaking" of the nail[7], which can be difficult to correct secondarily.

Cold intolerance, a consequence of the injury itself, may be present in upto one third of patients. Higher incidences of cold intolerance are noted with other methods of closure. Loss of tissue volume, instability of the pulp, changes in tip sensitivity, and joint stiffness have been reported.

REVISION AMPUTATION

A simpler course of action involves shortening the digit or revision amputation. This procedure is indicated in situations in which bone is significantly degloved, and the angle of the injury is such that other options are not appropriate. Care is taken to limit loss of length, particularly in treating the thumb. This procedure can be performed under local anesthesia in the acute care setting. Flaps are developed to cover the tip of the digit, preferably with volar skin. Using the volar skin rather than the dorsal skin provides a more padded and durable soft tissue cover for the fingertip. Patients can return to their activities as tolerated when the soft tissues have healed.

Other treatment options include

Skin grafts

Composite grafts

LOCAL FLAPS

Kutler lateral advancement

Atasoy volar advancement

REGIONAL FLAPS

Thenar flap

CFF

Homodigital island flap

DISTANT FLAPS

Abdominal flap

FREE FLAPS

Free toe pulp transfer

SHORTENING AND CLOSURE

REGIONAL FLAPS

Regional flaps are defined as flaps taken from other parts of the hand that do not use tissue adjacent to the defect. They are well-suited for volar oblique type injuries. Owing to the postoperative immobilization required, the procedure is often discouraged in patients predisposed to finger stiffness. This includes patients older than 50 years of age, those with rheumatoid arthritis, and patients with multiple injured digits.Patients with other co-morbid conditions like diabetes, hypertension, cardiovascular disease, etc. These flaps are also not well suited for young children because of lack of compliance and the fact that simpler methods are usually adequate.

Thenar flap

The Thenar flap was first used by Gatewood[33] to resurface an index fingertip pulp more than 70 years ago and is one of several two-stage procedures used by hand surgeons. The thenar flap is most applicable to the index and middle fingers with significant pulp loss. Application to the ring and small fingers is less often indicated and most difficult technically in the small finger.

The donor skin from the thenar eminence is thicker and more durable than the cross-finger flap, with better color and texture match and the donor scar is less conspicuous. However, the thenar flap represents a two-stage procedure requiring immobilization of the finger in flexion.

As such, proper selection of patients is essential to minimize complications relating to joint stiffness. Older patients and those with joint disease are at a higher risk for development of joint stiffness. Preexisting arthritis, joint injury and Dupuytren contracture are relative contraindications to this procedure.

The original thenar flap design has undergone several modifications[34] to minimize morbidity while maximizing its versatility. Smith and Albin designed the donor site as an H flap. . This eliminated the need for a skin graft over the thenar eminence.

In 1981,modification of the thenar flap was made by Russell et al fication of the thenar flap. They placed the donor site in the metacarpophalangeal joint crease of the thumb, with care taken to preserve the integrity of the neurovascular bundles and flexor pollicis longus. This new donor site is easily reached by the index and middle fingers and can be closed in alinear fashion with thumb flexion. This eliminates the need for a skin graft and places the scar in a relatively protected area outside the palm. Return of full thumb extension is the rule[35,36].

CARDINAL PRINCIPLES

- Design the flap out on the thumb close to the MP joint crease•

  Fully flex the MP joint and, once potential, the distal scientific discipline joint of the recipient finger to reduce proximal scientific discipline joint flexion

- Divide the pedicle of the flap once ten to fourteen days and now begin active exercises

Reconstruction of a distal volar index finger soft tissue defect with exposed profundus tendon using a flap from the thenar eminence was first described by Gatewood in a 1926 case report in the Journal of the Amercian Medical Association. Interestingly, Gatewood was a Chicago general surgeon who had only one name. He described a “horsehoe shaped flap”, which was ulnarly based and elevated off the thenar eminence. It was “planned so that when reflected, the blood supply would be interfered with a little as possible”. He did not mention what he did with the donor site defect, which apparently was allowed to heal by secondary intention.

A number of other closure options were advocated in the literature after 1926,

1934, including full-thickness Wolfe grafts by O’Malley

1947, lateral V-Y advancement flaps by Kutler

1950, local cross finger pedicle flaps from the dorsal surface of an adjacent digit by Gurdin in 1950 and Cronin in 1951. The thenar flap was again rediscovered by Adrian Flatt in 1955, and the technique more fully detailed in a 1957 article in the British Journal of Bone and Joint Surgery. Dr. Flatt initially described the technique as a "palmar flap" in 1955 but changed the name to a "thenar flap" in his 1957 description of the technique. He described a proximally based then flap, which should not be more than twice it's width," that was elevated off the thenar eminence with "about two third of the thickness of the subcutaneous fat carried on the flap. Flatt advised against flexing the injured digit too far into the palm, elevating the flap too much toward the ulnar side of the hand, dividing the flap too early before adequate revascularization had occurred or too late leading to stiffness of the reconstructed digit.

Barton, in 1975, presented a modification of the techniques similar to the original description by Gatewood, using an ulnarly based square shaped flap but elevated from closer to the metacarpophalangal (MP) joint flextion crease. This was said to require "slightly less flextion" of the injured digit and was" easier to apply the split thickness graft to the donor area"

In 1976, Smith and Albin described an alternative donor site closure method for the thenar flap using an H-shaped incision ove the thenar eminence. Proximally and distally based flaps were elevated and advanced towards each other to cover the fingertip, which was immobilized for 14 to 17 days. The

proximal flap was then detached proximally and the distal flap was detached from the finger. The divided proximal flap was then sutured to the volar edge of the fingertip defect to close the finger, and the detached distal flap was advanced proximally to close the donor defect in the palm. This technique avoided a palmar skin graft and the “risk of painful scarring”.

Traumatic amputation of a fingertip is the most commonly seen upper extremity injury. A number of closure options have been reported in the literature, including skin grafts, local V-Y advancement flaps, volar advancement flaps, or cross finger flaps from the dorsal or lateral surface of an adjacent digit. Another option for fingertip closure is a flap elevated from the palm of the hand, either from the thenar eminence, the mid-palm, the MP joint flexion crease or the hypothenar eminence. The injured digit must be flexed into the plam, and therefore, these flaps are best suited for younger patients with supple digits – especially children. Thenar flap is best suitable for transverse and volar oblique amputations and skin loss. . A defect that involves two thirds of the volar soft tissue pad or less is ideally suited for a palmar flap. A smaller tip defect can be closed with an MP flexion crease flap. A defect that involves the entire volar surface of the digit is probably better treated by using a cross finger flap. Digits that have sustained multiple tissue injuries with fractures or divided digital arteries, nerves, or tendons are less suitable for closure of

fingertip defects using a palmar flap because prolonged stiffness may result from immobilization of the digit in the plam.

Elderly patients or those with systemic disease resulting in digital stiffness such as arthritis or Dupuytren's contracture are usally not candidates for the prolonged immobilization required with a palmar flap. Patients with decreased peripheral blood flow such as those with collagen vascular disease or diabetes mellitus also are poor candidates for pedicle flap closure of fingertip injuries.

Palmar flaps are best done using an arm or forearm tourniquet and general or regional block anesthesia. The injured digit must be thoroughly debrided of macerated or severely contaminated tissue before proceeding with flap closure. I use a hand-held spray bottle or 10 cc syringe saline to thoroughly irrigate the finertip wound before and after the skin edges and subsutaneous tissue are carefully debrided with iris scissors and scalpel No :15 before flap coverage. The tuft of the distal phalanx also may require some debridement to the level of the remaining dorsal nailbed. The injured digit is then flexed into the palm to determine the best location and type of palmar flap that can be used for fingertip closure.

The best option for closure of a fingertip amputation on a radial digit is to elevate a flap from the MP joint flexion crease of the thumb. The donor site is

clearly visible in most individuals; it is skin between the two creases formed by flexing the MP joint of the thumb or finger. The flap is radially based and elevated to a width of 1 to 2 cm. It can be extended to a length of 3 to 4 cm around the base of the thumb. The distal end of the flap is tapered to facilitate primary donor site closure. It is raised with palmar facia at the level of the flexor pollicis longus tendon and care was taken to preserve the digital neurovascular bundles, identified, and protected. This flap is best used for distal tip loss and does not provide as much tissue volume as is possible with standard palmar flaps. The flap is suitable for index and mid finger rtips and in some patients the ring and little fingers. The donor site is closed primarily by flexing the thumb at the MP joint and avoids a palmar scar. The injured digits also is held in less flexion than is required for a palmar flap, decreasing the chances of residual digital stiffness. The thumb regains full extension after healing and the donor site is nearly invisible. All thenar flaps require the digit to be immobilized with a splint for 12 to 18 days using a dorsal plaster or thermoplastic splint.

Patients who have undergone fingertip reconstruction using palmar or thenar crease flaps have regained good sensibility in the flap that is less than normal but appears to be greater than is achieved in standard cross fingerflaps. Glabrous skin finertip reconstruction usually provide stable soft tissue coverage, which permits individual who perform manual labour to return to work. Some

residual digital stiffness has been observed in older patients, especially males with thick heavy hands. Other types of digital reconstruction may be less likely to cause stiffness.

Complications from the procedure are infrequent if care is taken to provide precise surgical technique and gentle handling of tissue. If the three cardinal principles are followed then complications can be minimised and good functional and aesthetic outcome can be achieved. Early active mobilisation of the injured finger and the thumb can avoid contracture and stiffness. Thenar flap is ideal for young females involving index and mid fingers and also suitable for children. The greatest advantage of thenar flap over cross finger flap is it provides glabourous skin of like nature with adequate sensation over a time period of 6 to 8 months. When compared to cross finger flap i njuries to the adjacent finger can be avoided .

Cross-finger Flap

In 1950 Gurdin and Pangman[37] first described this flap , is a robust flap that uses dorsal skin of an adjacent finger to construct volar fingertip injuries in two stages. It provides durable cover for volar oblique defects with exposed bone, tendon or joint when available local flaps are inadequate and preservation of length is essential. This is often the case in the distal index finger or thumb and inpatients with multidigit injury in whom preservation of length in the

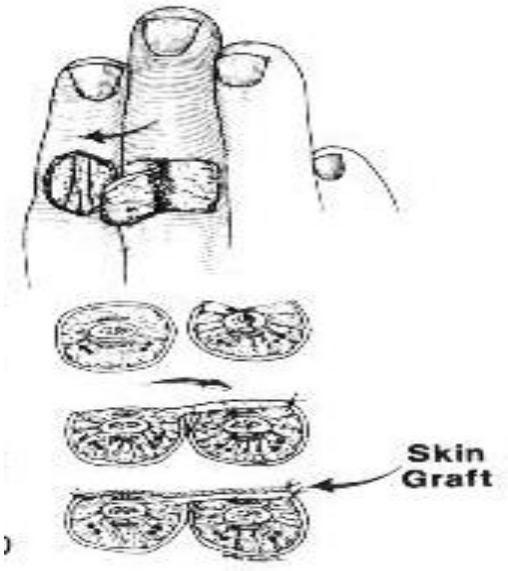
remaining digits is of high priority[38]. There should be sufficient intact nail bed and distal phalanx to warrant fingertip salvage. With an uninjured adjacent finger available as donor, defects as large as 1.5x2.5 cm can be covered. The donor site on the dorsum of the adjacent digit is skin grafted, resulting in a visible depression with cosmetic consequences.

Since this is a two-stage procedure requiring immobilization of the involved digits for 2 to 3 weeks, patients susceptible to joint stiffness are not good candidates for this technique. This includes older patients and those with preexisting arthritis, joint injury or Dupuytren's contracture. Finally, intrinsic vascular conditions in the patient, such as diabetes, atherosclerosis and tobacco use are relative contraindications to use of the cross-finger flap.

The blood supply to this flap is random; therefore, it can be proximally, distally or laterally depending on the relative position of the defect to the donor area. This flap is raised on the radial side on the dorsal skin of middle phalanx of the digit ulnar to injured fingertip. Beasley has even used the glabrous volar skin of the middle finger to resurface the thumb and some dorsal defects. In general, under tourniquet control, a lint pattern somewhat larger than the defect is taken and marked over the dorsal aspect of the donor finger. The flap should be larger than the defect to minimize tension and to optimize viability. A medially or laterally based skin flap is elevated just superficial to the extensor paratenon and opened like a book. Some suggest replacement of the entire

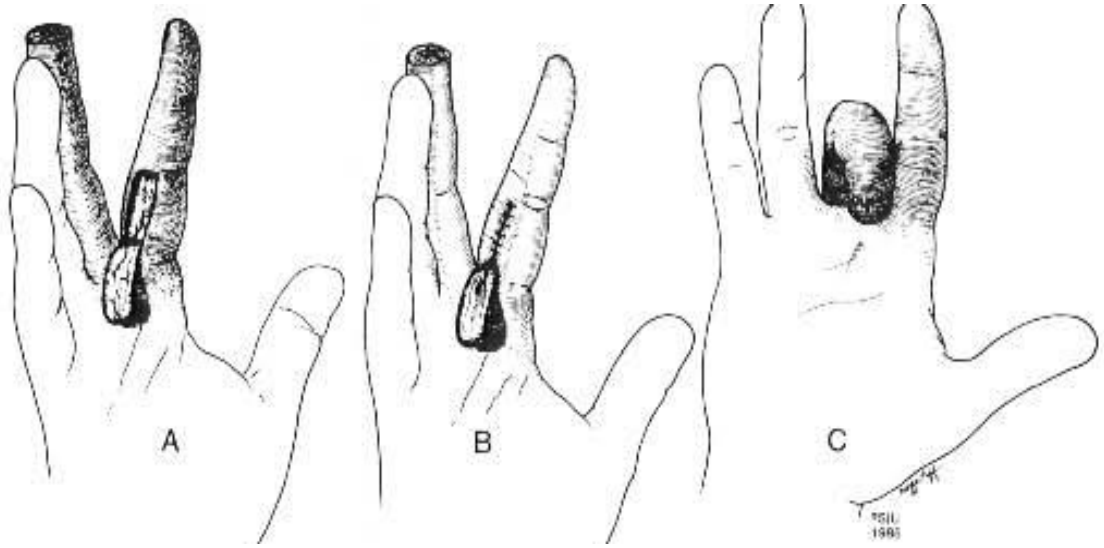
anatomic unit containing the defect to improve flap viability and to hide the scars better. Others aim to preserve as much sensate native skin as possible. The flap is mobilized to allow inset without tension and the donor and recipient fingers are immobilized to each other with sutures or K-wires and placed in a splint. Care is taken to preserving the paratenon over the extensor tendon and the donor defect is covered with skin graft. The flap division is done after two weeks and inset is given. To avoid joint stiffness active and passive exercises are started at this time after division. The pedicle has been divided safely as early as 8 days after flap elevation to further decrease joint problems, although this is not common practice.

To improve sensation, the dorsal sensory branch can be included in the flap and approximated to the digital nerve of the injured digit. Cohen and Cronin find improved sensibility with primary neurorhaphy[39].



A reverse cross-finger flap[40,41] is done for dorsal raw areas. This flap is de-epithelialized and inset with the dermis down. If additional bulk is needed for an injured fingertip, the de-epithelialized flap can be rolled on itself. This requires coverage with two skin grafts, one for the donor defect and one for the new surface of the flap[42].

The skin graft for the donor defect can be avoided by raising a laterally based thin epidermal flap before elevation of the dermal cross-finger flap. This epidermal flap can then be placed back on the donor defect in lieu of a skin graft.



The side cross-finger flap is a variant that has improved cosmesis and can provide quality coverage for the thumb or fingertip. It is based proximally in the web space of the adjacent finger and centered midaxially over the proximal phalanx. It can extend beyond the proximal interphalangeal joint and can be upto 2cm wide. When placed on the ulnar aspect of the donor finger, the scar is

hidden from the patients view. The side cross-finger flap is best for thumb tip amputations, although it can be used for any fingertip injury in young patients, in whom joint stiffness is less likely[43].

Before its development, in 1890 literature tells such palmar and dorsal finger injuries were managed with cross-arm flaps, thoracic or abdominal flaps, or amputation; for fingertip injuries with bone being exposed, the wounds were allowed to close secondarily or were covered with thenar flaps, or the finger was shortened and the soft tissues closed. The cross-arm, thoracic, or abdominal flaps are cumbersome for patients, and children are nearly not possible to immobilize . This flaps are bulky and are poorly matched for the hands. Digital amputation or shortening can affect agility, strength, and aesthetic form.

In 1950, Gurdin and Pangman made the first written report on experience with the cross-finger fiap.

In 1951, Tempest described various modifications of the procedure for use in special circumstances.

The flap is particularly well suited for coverage of wounds exposing FDS,FDP tendon or terminal phalanx bone. Indications cross finger flap includes

1) coverage of the soft-tissue deficit resulting from flexor tenolysis and proximal interphalangeal joint capsulotomy for a severe flexion contracture;

2) replacement of badly scarred soft-tissue over the palmar aspect of the finger in preparation for later staged flexor tendon grafting.

3) acute coverage of an exposed, injured flexor tendon after an avulsion injury of the plamar skin and fat of the finger; and

4) coverage of a severe “knuckle” abrasion, with loss of dorsal skin, subscutaneous fat, extensor mechanism, and an open proximal interphalangeal joint.

5) The cross-finger flap may also be indicated for closure of fingertip and pulp injuries and for stump closure after amputation to retain the lengh. The flap provides one method of preserving digital length, particularly in oblique injuries having significant pulp loss.

The procedure can even be performed under digital block. Children should be operated on under general anesthesia.

The procedure must be performed using tourniquet control and the aid of magnifying loupes. Meticulous hemostasis must be maintained and obtained with bipolar cautery. The flap should be handled with delicate skin hooks only.

Care should be given to the injured part and should be concentrated more before operating. The acute wound should be irrigated and debrided of any devitalized tissue or foreign material. The chronic would should be restored to

its acute state. Elevate and freshen the wound margins and excise or incise contracted scar tissue to restore the wound to its original dimensions. Make a template of the wound.

For fingertrip injuries, other options of treatment are healing by secondary intention, bone shortening and closure, skin grafts, volar advancement flaps, palmar flaps, distant pedicle flaps, composite grafting, microneurovascular replantation, and microneurovascular toe pulp or oncho-osteocutaneous transfer. More promixal wounds that are not amenable to primary closure or skin grafting may be closed with V-Y falps, neurovascular island flaps, distant pedicle flaps, or several forms of microvascular free-tissue transfer.

Several technical errors may result in an unsatisfactory outcome. These can occur at each stage of the operation, including wound-site preparation, flap design, flap elevation and insetting, and flap division. Such errors may produce immediate consequences, such as flap necrosis, or late consequences, such as joint contracture.

Failure to use a wound template and to carefully orient and design the flap can result in a flap that simply does not reach all of the wound margins. This can be avoided by transposing the wound template between the wound and the donor sites. If the template does not reach, neither will the flap.

It is critical to maintain as wide base (the hinge) when designing this random-pattern flap. Designs that require back-cuts or a tapered hinge greatly increase the risk of flap necrosis. For the same reason, the surgeon must prevent tension or torquing across the flap base.

Conversely, a skin graft placed over a segment of the aesthetic unit is invariably ugly.

Be careful not to divide the delayed flap too closely to the recipient side. The flap is usually bulky and stiff from edema at this stage. The surgeon needs a generous margin on the flap to inset its proximal longitudinal border. An insufficient margin may result in an incompletely covered wound or in a longitudinal scar over a joint.

Postoperative rehabilitation, including the home program, should be discussed with the patient preoperatively. When possible, the patient should also meet the hand therapist preoperatively. If other injuries do not contraindicate it, the patient should begin a hand therapy program immediately after the second stage of the procedure. Active and passive movements are initiated and edema control by hand elevation. Later, patients require instruction in scar massage; some may need pressure garments fitted if hypertrophic scarring develops. Patients also need assistance in a desensitization program.

A well-designed and carefully inset flap and skin graft, this technique provides a satisfactory aesthetic result. In lightly pigmented patients, it provides an excellent color match; however, in deeply pigmented patients it may result in a patchwork-quilt effect. It provides a durable and reliable surface for the finger. Hyperesthesia of the flap rarely occurs.

Most patients who undergo a noninnervated cross-finger flap have return of protective sensation (8mm two-point discrimination) but the sensation in the flap remains less than that in normal pulp. The two-point discrimination distance in the flap is about twice that in normal pulp. The return of sensation is best and most predictable in young individuals(< 20).Old patients above 40, only about half regain protective sensation. The potential for sensory return is significantly compromised by seroma or infection beneath the flap during early healing. Bacterial control of the wound and metic ulous operative technique are critical to the immediate and long-range outcome of the procedure.

Patients who are without concomitant finger injuries, who have a minimum delay before pedicle division, and who begin range-of-motion therapy immediately after the second-stage procedure usually regain full joint motion. This is true even in older patients. Early flap division and a routine well-organized postoperative hand therapy program are the variables that the surgeon can readily influence to improve range-of-motion outcome.

Patients who work at manual labuour can return to work after an average of about 70 days, there are some patients who require more time to return to work, particularly those having associated injuries. People with physically sedentary jobs may return to work earlier.

COMPLICATIONS

Infection—nail bed injuries and tip injuries can be quite dirty. Antibiotics should be used appropriately to treat infections.

Nail ridges and split nails—may require excision with primary repair or free nail grafting, depending on the size of the injury.

Hooked nail deformity—usually caused by loss of distal phalangeal bone support. May need shortening of nail bed or more tip support.

Fingertip grafts and flaps can be lost secondary to necrosis, poor flap design and execution, as well as patient noncompliance. Preoperative planning is the best prevention for these complications.

Cold intolerance - most patients suffer from some form of cold intolerance after a fingertip injury, varying with the extent of injury. This can be expected to be permanent and patients should be counselled as such, although cold intolerance does tend to improve partially over the first 2 years following the original injury.

Neuroma - a painful neuroma can form in more proximal amputations when digital nerves are not padded sufficiently. Nerve resection and retraction at the time of surgery can sometimes prevent this complication. Resection of a neuroma may be required postoperatively if conservative treatment with desensitization fails

Complications of skin grafts include hematoma, necrosis of the skin graft, and donor site complications.

The resultant suture line in advancement flaps may be the cause of hypersensitivity noted by some patients. Advancement flap complications also include numbness, cold intolerance, and dysesthesias.

The other complications of thenar flap include scar contracture and joint stiffness , apart from infection and flap necrosis and wound dehiscence .

The complications for cross finger flap include donor site morbidity and dark colour patch in the volar aspect and sometimes bulky.

MATERIALS AND METHODS

Nature of study	Prospective study
Total number included	45
Group I Thenar flap	19
Group II CFF	26
Study done in	IRRH&DPS Department of plastic surgery Govt Stanley medical college Chennai -1
Period of study	September 2011-February 2014

Other departments Involved	Anesthesia , Radiology, Casualty and physiotheraphy,
Ethical committee approved	yes
Follow up period	Shortest -Two months Longest - Two and a half years

An informed consent was obtained before doing the surgical procedure.

All routine basic investigations were carried out before the surgery and procedure.

X rays of the involved hand anteroposterior and oblique views were taken in all the cases preoperativey and if required postoperatively.

The proforma was duly filled.

The procedure and complications were explained.

Age, sex, mode of injury, type of injury, duration of flap division, and donor site morbidity and complications, were analysed.

Colour match texture, sensation, aesthetic appearance were considered in the study

The results were analyzed.

Photos of the injured hand were taken both preoperative and postoperative period after informing the patients .

Patients were informed about presentation and publications in conferences and journals if necessary.

INCLUSION CRITERIA

1. Age group between 4 years - 40 years
2. Acute fingertip injuries with defects exposing bone or tendon
3. Transverse or oblique amputation distal to dip joint

4. Paucity of soft tissue and more volar loss
5. Previously injured adjacent finger

EXCLUSION CRITERIA

1. Age less than 4 years and above 40 years
2. Multiple injuries in the same finger
3. Thumb injuries
4. Mangled extremity
5. Major crush injury
6. Previously injured stiff finger
7. Stiff joints
8. Other systemic or co-morbid conditions

OPERATIVE PROCEDURE :THENAR FLAP

A standard thenar flap is done by flexing the injured fingertip into the palm, and the dimensions of the flap are determined by the size and shape of the finertip defect. A proximal or distally based thenar flap, slightly larger than the finertip defect is elevated at the level of the muscle fascia. The finger is flexed into the palm to rest in a relaxed position. The corner of the digital defect can be sutured to the edge of the donor defect in the palm with a 4-0 nylon suture to reduce tension on the flap. Donor defect is closed primarily with 4-0 nylon suture. The tourniquet is released and the blood supply to the flap determined by

observation. To preserve adequate blood supply, the base of the flap must not be excessively kinked or folded. A similar flap can be elevated from the hypothenar eminence to close digital defects on the ulnar digits.

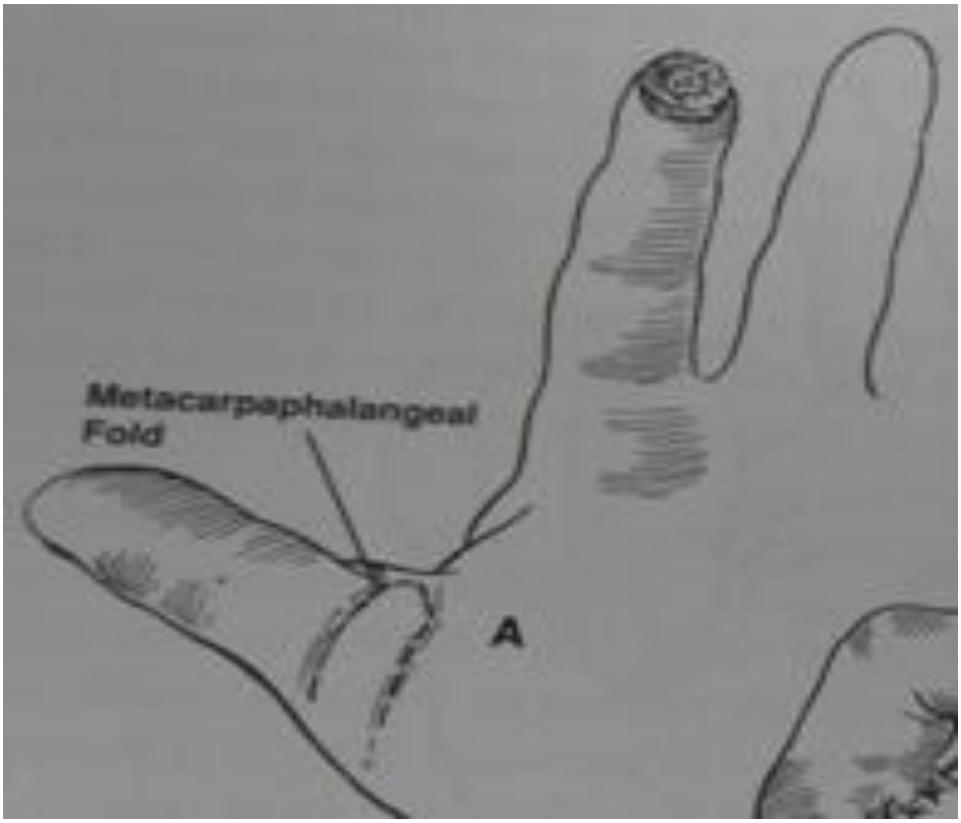
We modified the thenar flap for ulnar digits by elevating a proximally based palmar flap the thenar crease area. This flap is planned in a similar fashion by flexing the injured digit into the center of the plam. The flap is designed to a maximum width of 2 cm along the thenar crease and is tapered distally. It is elevated at the level of the palmar fascia including the skin and palmar fat. The palmar skin edges are undermined slightly allowing the donor site to be closed primarily by slightly adducting the thumb.

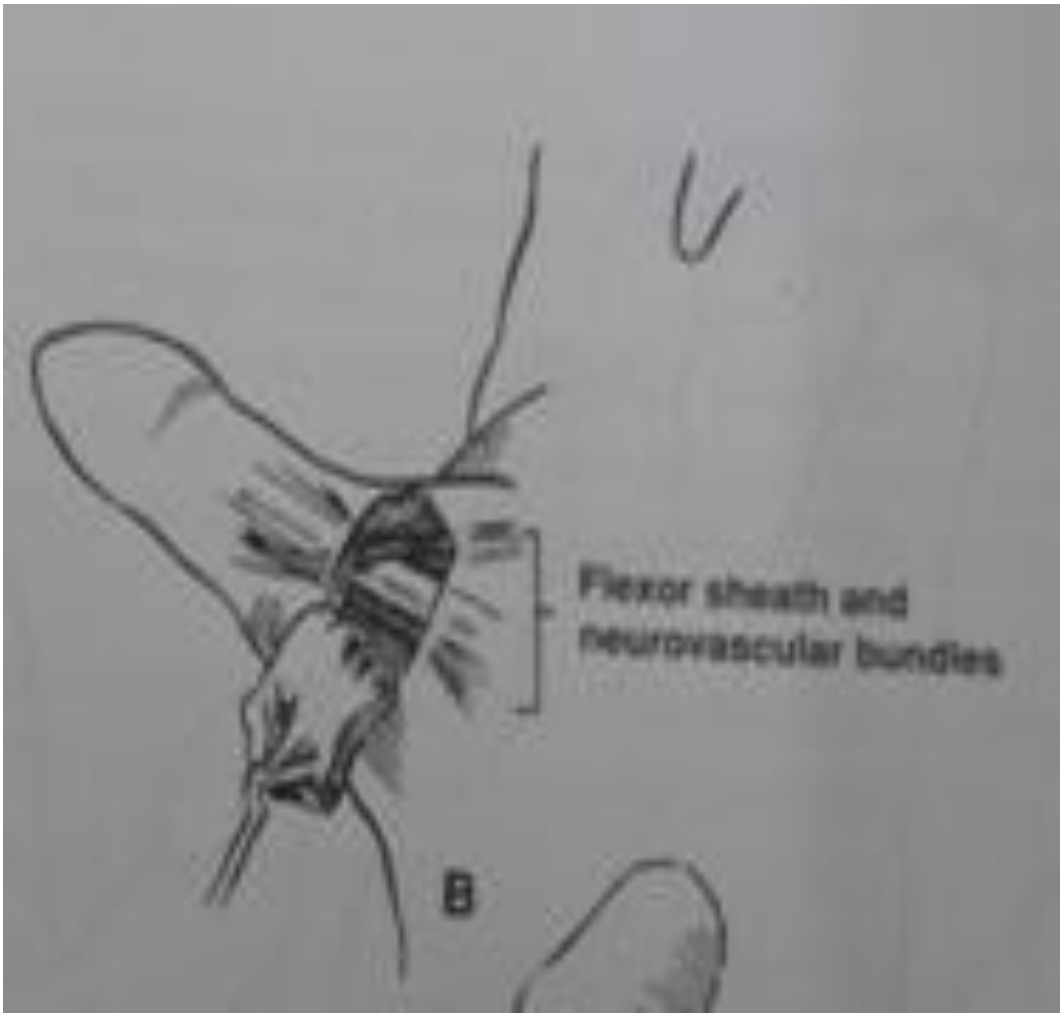
The tourniquet should always be released to be sure the attached flap has sufficient blood supply. All thenar flaps from any location in the palm have the disadvantage of leaving a scar or skin graft in the palm, which on rare occasions, can be symptomatic, especially in patients who use their hands for laboring activities. The authors preference for fingertip closure from the palm is an MP joint flap.

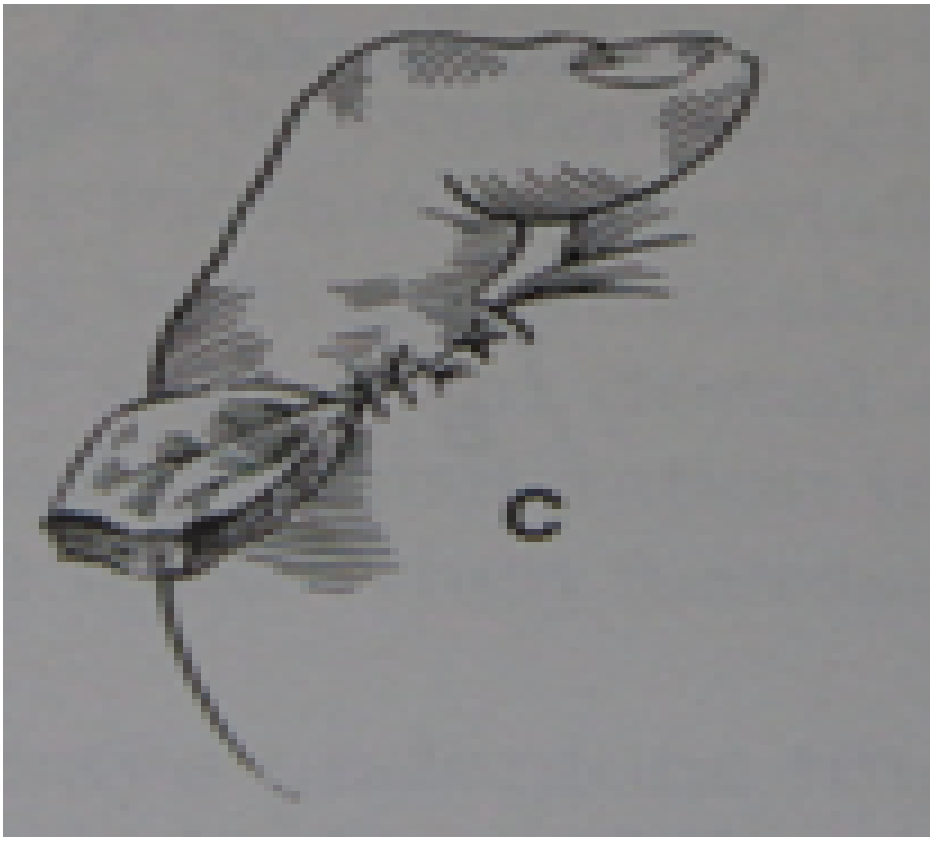
The MP flexion crease flap has the disadvantages of providing less volume of tissue than is possible with standard thenar flaps. Injury to the digital arteries and nerves of the thumb are possible if careful dissection of the flap is not performed .

The advantages of the MP joint flexion crease flap are that less flexion is required to inset the injured digit into the flap and the donor site is virtually invisible as a straight line over the volar surface of the MP joint of the thumb.

All thenar flaps require immobilization of the digit for 12 to 18 days, using a dorsal plaster or thermoplastic splint. Early active and passive range of motion is encouraged after the flap is divided and inset to prevent digital stiffness and to restore full thumb motion. Hand therapy to restore motion is especially important in all patients. All thener flaps provide digital resurfacing with glabrous skin, which may regain better sensibility and function than nonglabrous skin from dorsal cross finger flaps. Patients may later require sensory re-orientation and desensitization instruction for painful scars. Scar massage and pressure garments are used when necessary.


Metacarpephalangeal
Fold
A


Flexor sheath and
neurovascular bundles
B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OPERATIVE PROCEDURE: CFF

The cross-finger flap is most often called as a laterally based flap raised over the dorsal aspect of the middle phalanx. A cross-finger flap can also be proximally or distally based, and it can be elevated from the dorsal or lateral surface of the finger. It also can be raised over the proximal or middle phalanx. Selection of the flap design is based on the location and configuration of the wound and defect pattern.

Choose the finger adjacent to the injured finger that is easiest to position as the flap donor. Jumping cross finger can also be taken from non adjacent finger . Use the template (lint pattern) to select the optimal location and orientation of the flap, then mark the flap on the dorsal aspect of (MPX) middle phalanx of the adjacent finger. Usually, a laterally based flap is raised over the dorsum of the middle phalanx. The template outline is oriented so that it can be easily transposed to the wound when the flap is raised. The flap margins are drawn to incorporate the template outline. The transverse margins of the flap are ideally situated just distal to the proximal interphalangeal joint and just proximal to the distal interphalangeal joint. Skin grafting of this entire "aesthetic unit" of the finger (from one neutral line to another and from one joint crease to other) yields a cosmetic result that is superior to grafting of a smaller area. If necessary to provide adequate tissue, however, the proximal

transverse margin can be moved farther proximally to incorporate the skin over the proximal interphalangeal joint and the proximal phalanx.

We make incisions through the skin and subcutaneous tissues. Extend the incision down to the paratenon overlaying the extensor mechanism. This layer must be preserved. Elevate the flap between the paratenon and the subcutaneous tissue, beginning at the mid-lateral incision and progressing toward the opposite mid-lateral hinge. Avoid injury to the under-surface of the dorsal veins as you elevate the flap. When an innervated flap is planned, be sure to isolate and raise a segment of the dorsal cutaneous nerve branch proximal to its entry into the proximal flap margin.

The skin is anchored to the finger by multiple ligamentous fibers. Cut on to each lateral side of the extensor mechanism, cutaenous extensions of the oblique retinacular ligament. Cut also the transverse retinacular ligament and the lateral band.. Near the base of the flap, Cleland's cutaneous ligaments must be cut to provide full mobility to the flap.

With the flap completely elevated, release the tourniquet and obtain hemostasis. Next, provisionally inset it to the wound on the adjacent finger. Trim the flap concentrically with the wound margin; be sure to leave additional skin outside the original template outline to allow tension-free closure. Flap inset is given using interrupted 4 0 nylon sutures.

Skin graft is taken from the ipsilateral medial arm. We find that these sites provide a good color match. Some prefer to obtain the graft from the groin but this draker skin results in an unattractive color mismatch. Meticulously defat the skin. Suture it into place over the flap donor site and the flap hinge with fine 4 0 nylon sutures. Secure the graft with tie over bolster suture with 3 0 nylon. We find that a well-contoured we cotton dressing provides more reliable and even pressure application and superior protection from shear.

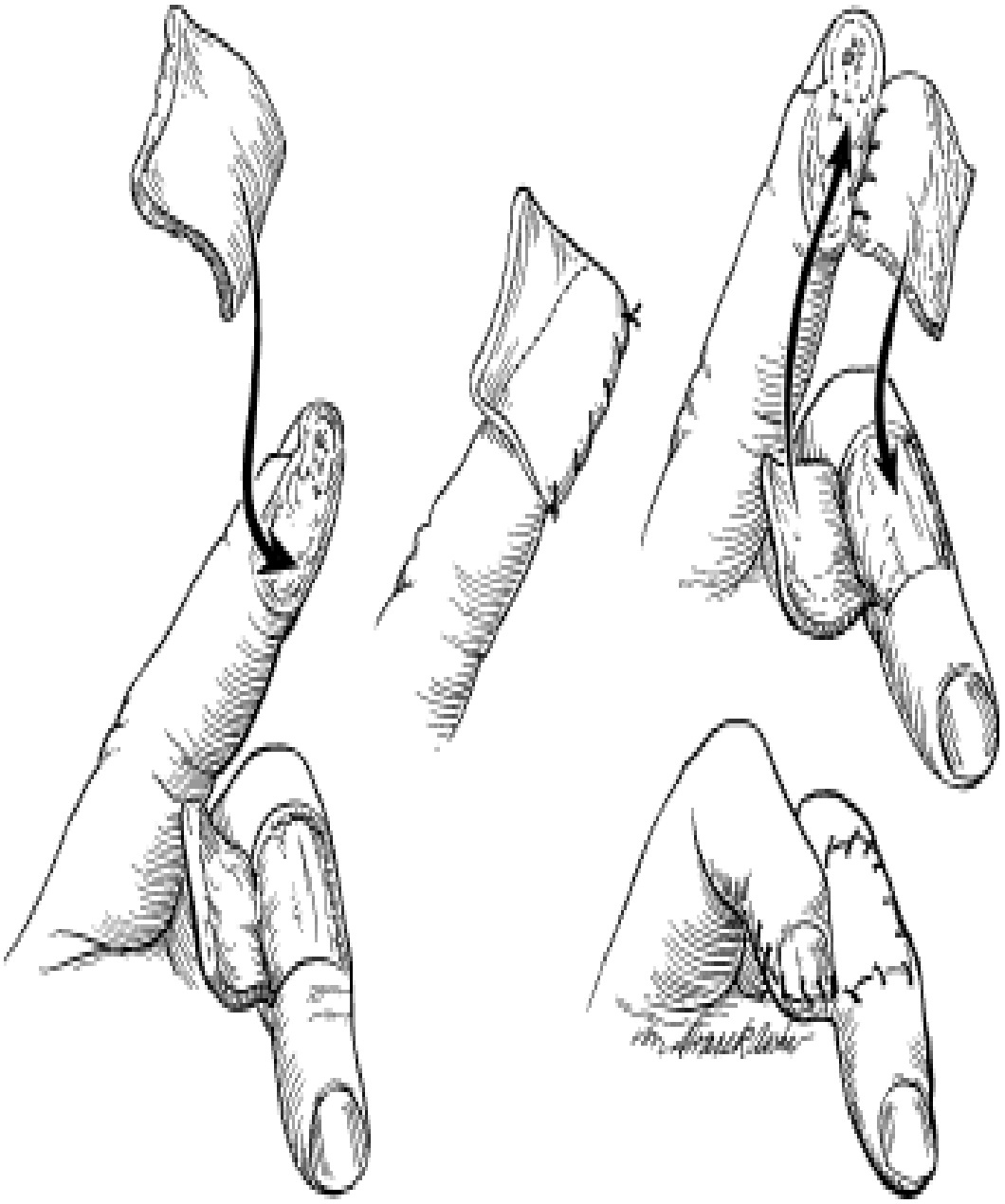
We dress the wounds with a nonadherent paraffin gauze. Be sure to place cotton or another soft dry gauze between all the fingers to prevent maceration. Pad the fingers and palm with cotton. Moisten the cotton and contour it over the skin-graft site. Secure this in place with cast padding, and apply a dorsal pop splint. We immobilize the hand in the intrinsic-plus position, with some necessary modification to prevent tension on the flap. In children, additional immobilization is necessary.

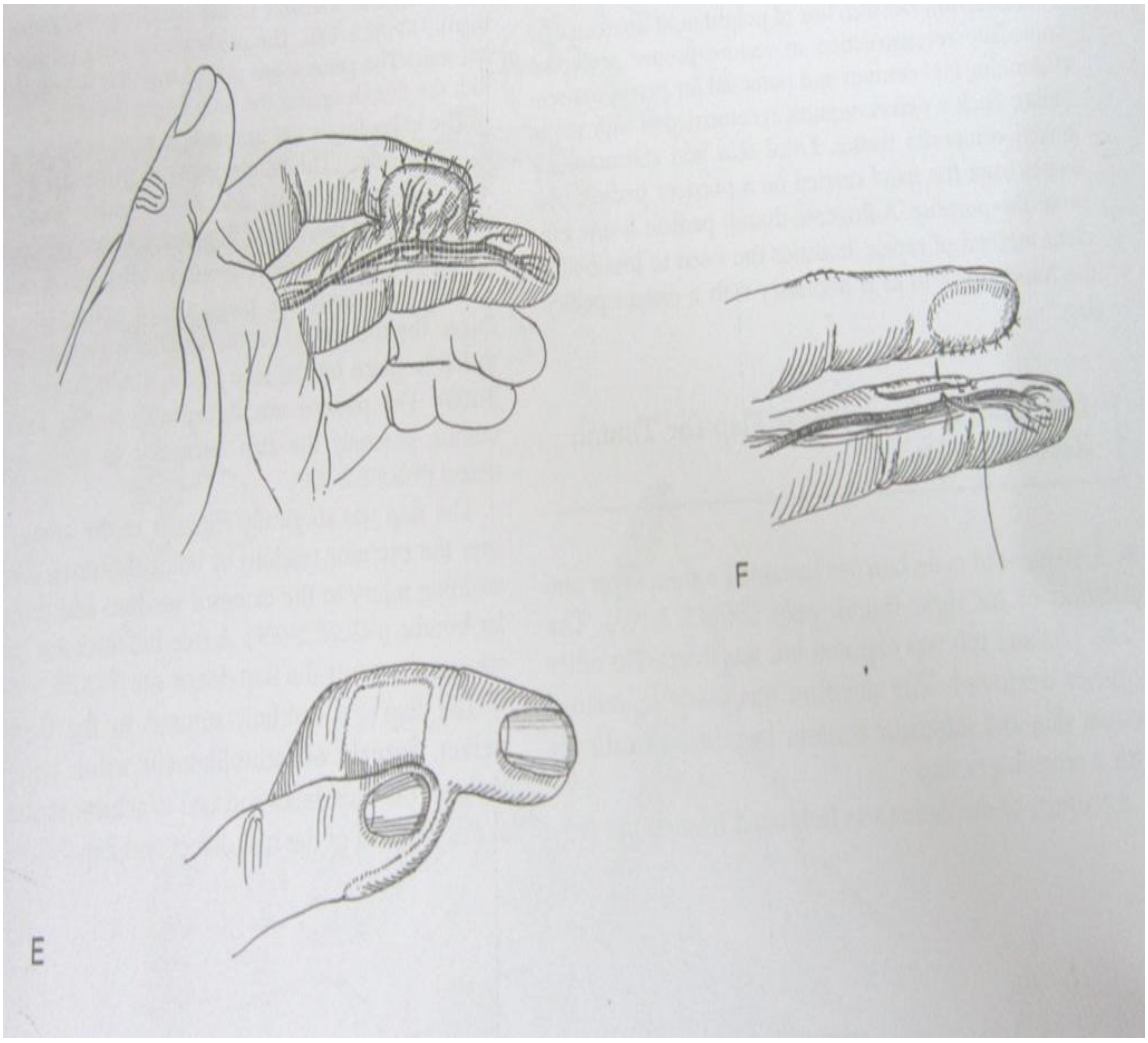
We use a long-arm cast, with the elbow flexed 90. Others use Kirschner wires drilled transversely from the proximal to the middle phalanx of the tethered fingers. Instruct the patient to keep the hand elevated above their heart.

The flap is divided after 2 weeks. Longer delays are unnecessary and contribute to finger stiffness. Flap division should also be performed in the operating room to allow elevation of the wound margin and meticulous insetting

of the divided flap edge. In adults, the procedure can be performed with digital blockade anesthesia; children should receive general anesthesia. Cover the wounds with only a light nonadherent dressing that does not interfere with motion.

Dorsal finger wounds can be covered with proximally or distally based cross-finger flaps or with a de-epithelialized laterally based, turn-over, cross-finger flap. When performing a de-epitelialized cross-finger flap, they to raise the epithelium and some dermis in a single piece, so that it can be replaced on the donor or recipient digit. Cover the remaining defect with a skin graft. The skin graft is taken from the ipsilateral arm and donor raw area is covered with non adhesive Vaseline dressing and is left in place for two weeks. The skin graft is applied over the donor finger and secured with tie over bolster dressing and below elbow dorsal pop slap is applied. The wound is inspected after 48 hours and sutures are removed on day 10. The flap is divided under local anaesthesia and finger bandages are applied. Active physiotheraphy is started after two days for both donor and injured finger .

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OBSERVATIONS AND RESULT ANALYSIS

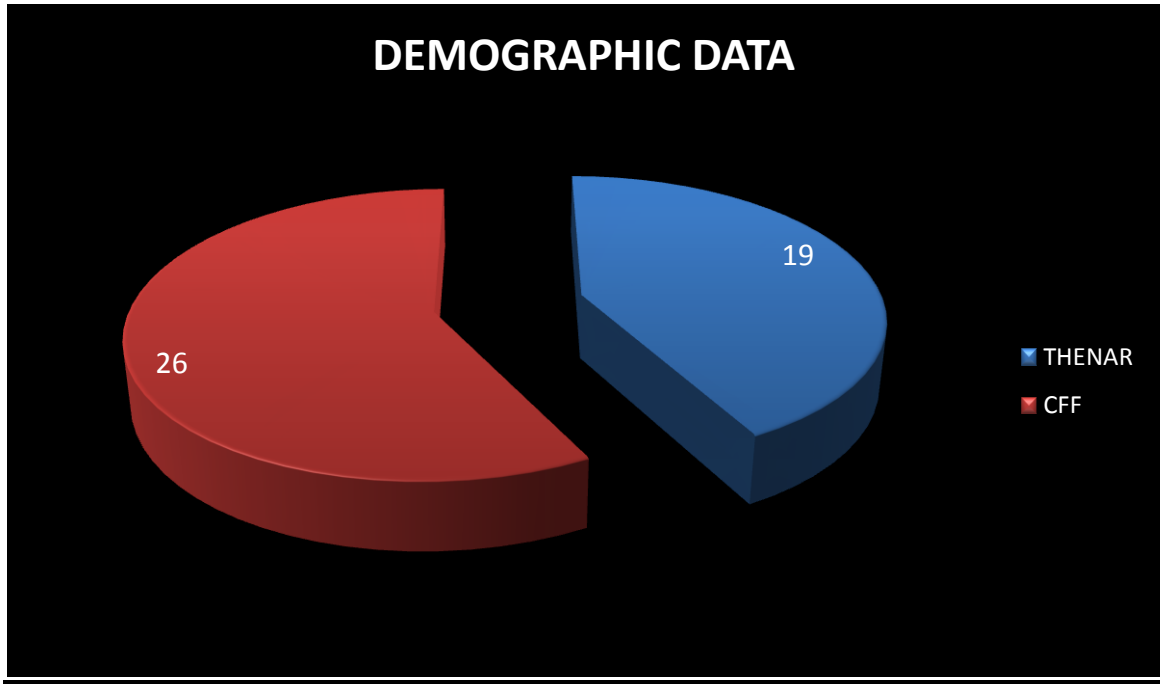
Over a period of 2.5 Years (30 months) from September 2011 to February 2014, a total of 45 patients with fingertip injury were studied. **Group I Thenar flap 19 patients and group II cross finger flap 26 patients** were studied. The injured were randomly put into the above groups. There was no strict criteria to fit the patients in each group.

Demographic distribution , method and mode of injury, type of injury, duration of flap division, donor site morbidity were studied in this series. The shortest period being two months and the longest being two and a half years.

DEMOGRAPHIC DISTRIBUTION

Table: 1

Total	45
Thenar flap	19
Cross finger flap	26

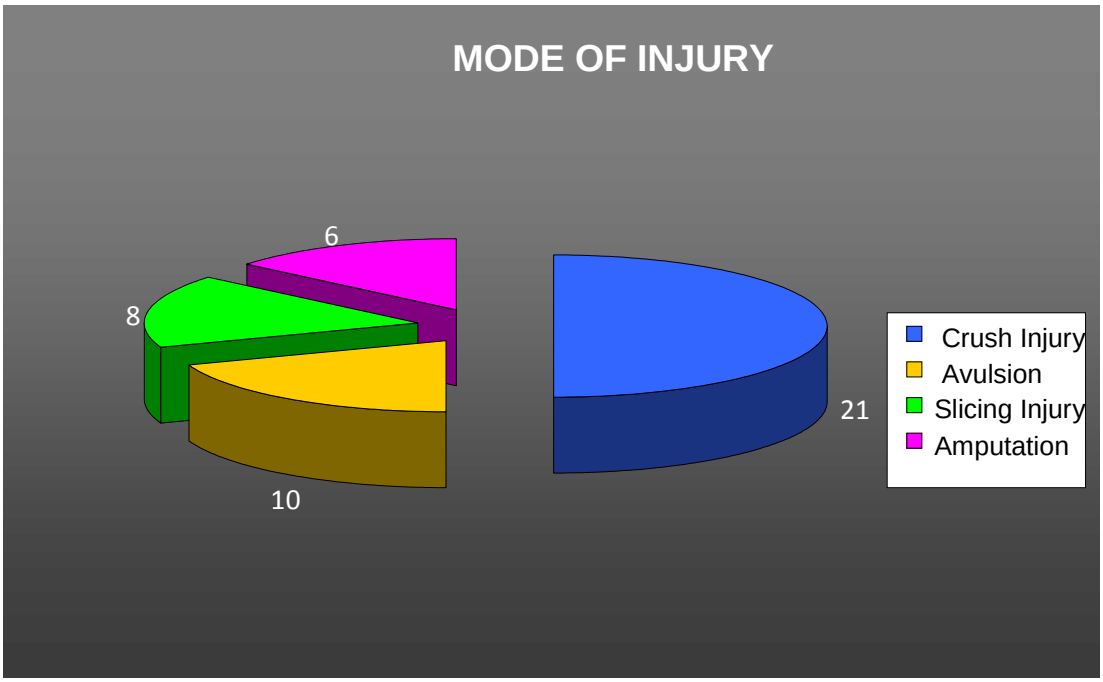


MODE OF INJURY

The commonest type of trauma to finger tip is Crush injury (n=21) avulsion(n=10) and slicing injury(n=8). There were six cases of clean cut amputation(n=6).

Table :2

Total	45
Crush injury	21
Avulsion injury	10
Slicing injury	8
Clean cut amputation	6

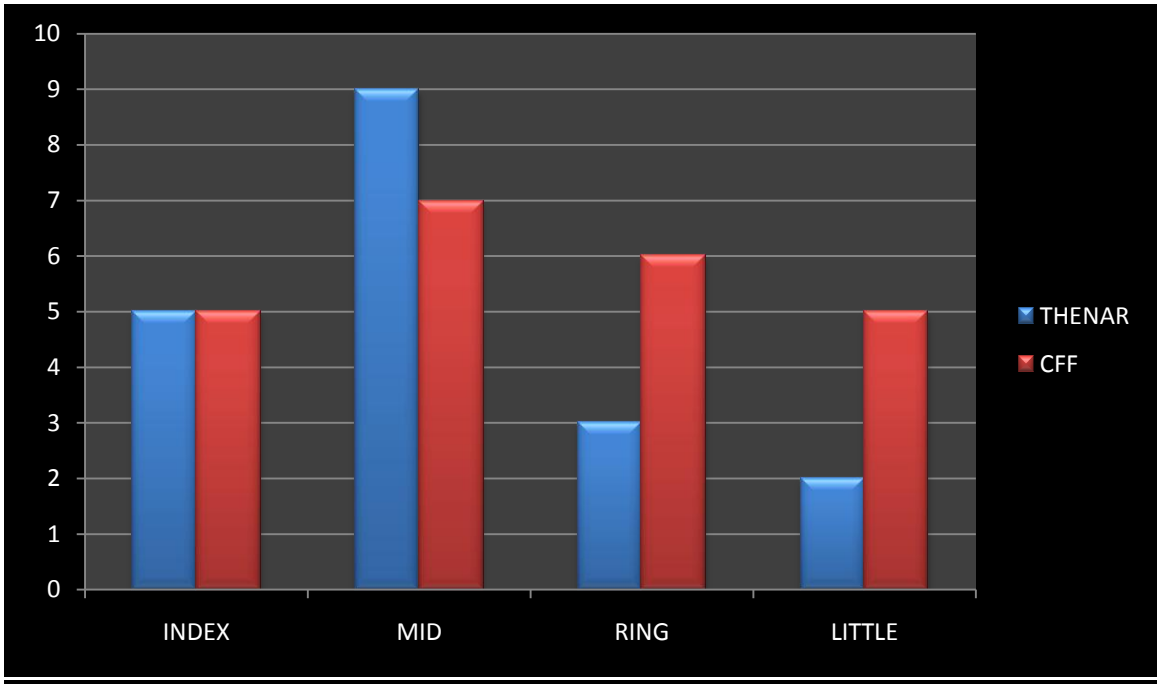


FINGER DISTRIBUTION

Of the 45 patients, Index finger was involved in 13 cases out of which five where in the thenar group and eight in the cross finger flap group, Mid (n=16),nine in thenar and seven in cross finger flap group Ring(n=9),three in the thenar and 6 in cross finger flap group and finally, Little(n=7) two in thenar group and five in cross finger flap group.

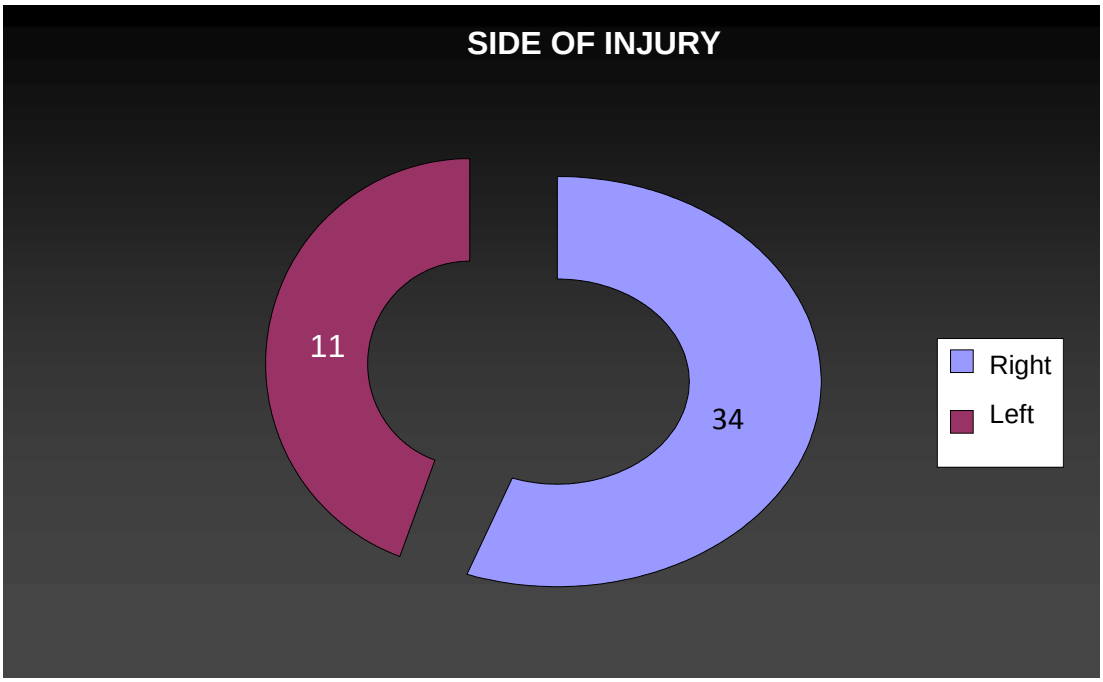
Table:3

Finger	Thenar	Cross finger flap
Index	5	8
Mid	9	7
Ring	3	6
Little	2	5



SIDE OF INJURY

Out of 45 patients(n= 34) were right sided ,14 in thenar flap group and 20 in cross finger flap group, whereas (n=11) were left sided out of which 5 belongs to thenar flap group and 6 belongs to cross finger flap group.

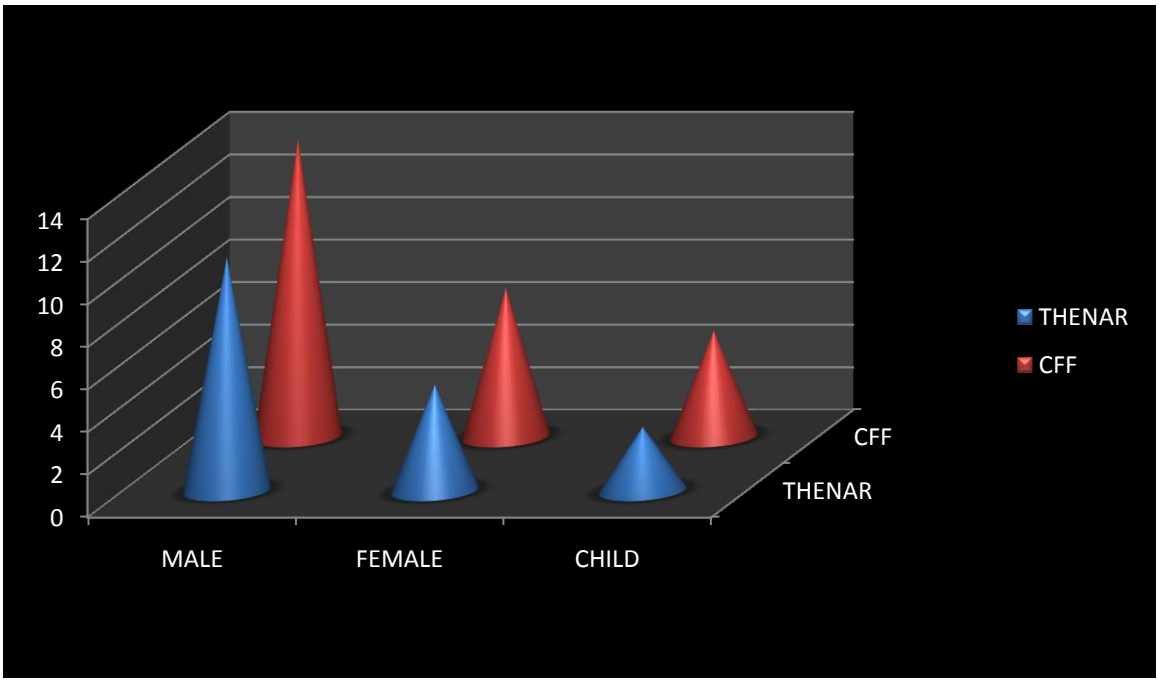


SEX DISTRIBUTION

There were 25 males, eleven in the thenar flap group, and 14 in cross finger flap group. Out of 12 female 5 in thenar group and 7 in cross finger flap group and out of 8 children there were three in thenar and 5 in cross finger flap group.

Table :4

Sex	Thenar flap	Cross finger flap
Male	11	14
Female	5	7
Child	3	5

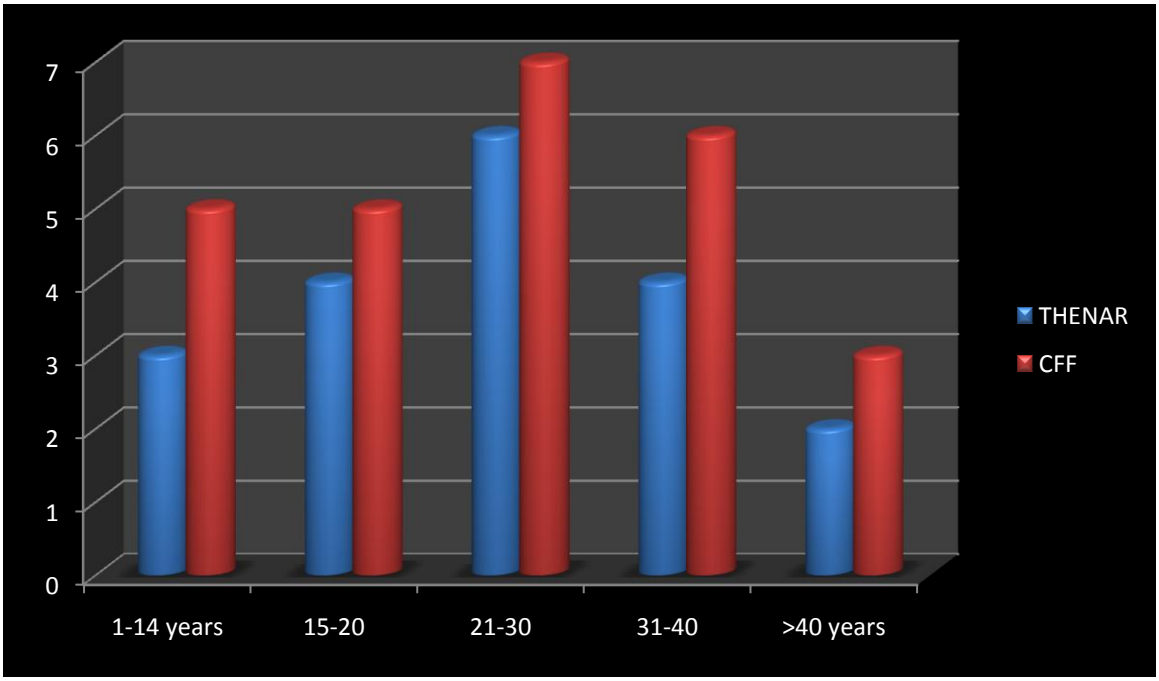


AGE DISTRIBUTION

Table:5

Age	Thenar	Cross finger flap
0-14 years	3	5
14-20 years	4	5
21-30 years	6	7
31-40 years	4	6
➢ 40 years	2	3

Of the 45 patients age 3 to 45 years,were ranging in this study and maximum number of injuries(28%) where found between age group of 20 to 30 years 13(n=45). youngest child was 4 years of age due door shut injury and sustained a crush injury with skin loss and the oldest patient in the study was 48 years sustained injury by industrial accident .



Of the 45 patients, majority of injuries occurred at work(n=23) industrial accidents which includes 21 men and 2 women and others due to RTA and assault (n=4)all four where me.

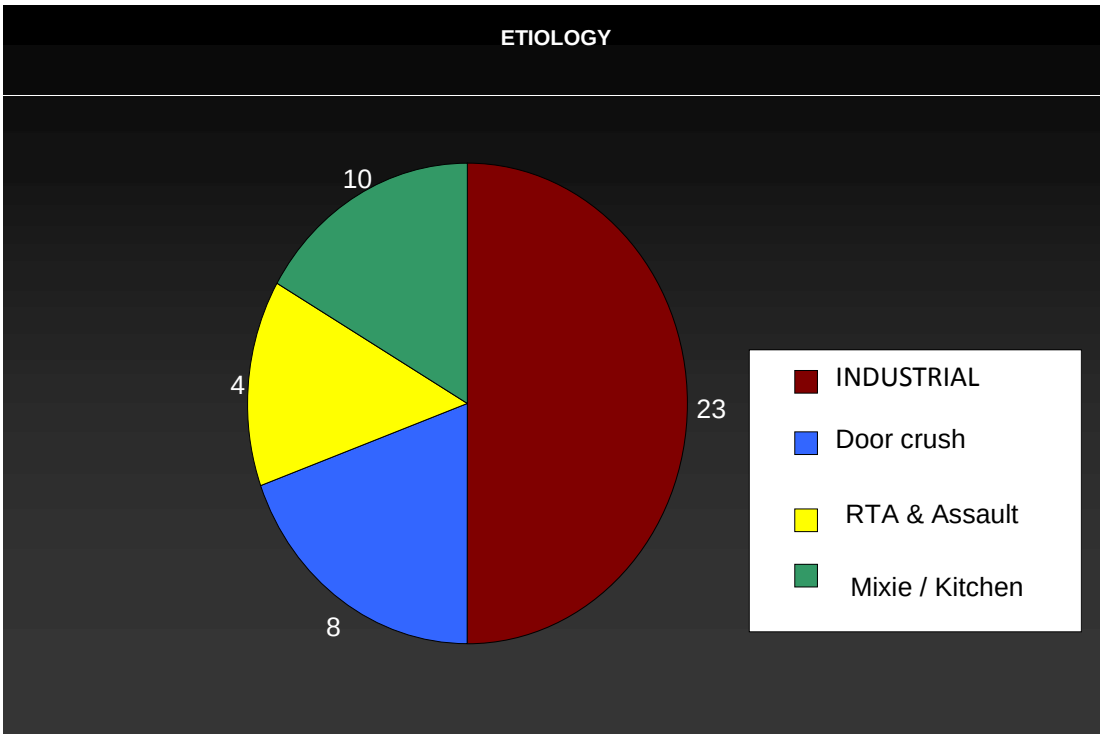
In children, 8 out of 8 were due to door crush(n=8).

Household work and mixie injuries at kitchen are common in female(n=10) out of 12.

MECHANISM OF INJURY

Table:6

CAUSE	NUMBER(n=45)	Male(n=25)	Female(n=12)	Child(n=8)
Industrial injury	23	21	2	-
RTA / Assault	4	4	-	-
Door crush	8	-	-	8
Mixie / kitchen	12	-	10	-



ASSESSMENT

- **SUBJECTIVE**
- **OBJECTIVE**

SUBJECTIVE:QUESTIONNAIRE

QUESTIONNAIRE RESULT (n=36)

Table:7

	POOR		FAIR		GOOD		EXCELLENT	
	THENAR %	**CFF %**	**THENAR %**	**CFF %**	**THENAR %**	**CFF %**	**THENAR %**	**CFF %**
SENSIBILITY	17	24	8	16	50	44	25	16
FUNCTION	0	1	8	12	25	30	67	57
APPEARANCE	0	34	0	16	25	26	75	24

Analysis of function

Overall function of the hand was assessed using questionnaire.

Patients were asked about the function of hand after surgery and were given the options of ‘very good’, ‘good’, ‘fair’, ‘poor’ and ‘very poor’. overall 95% of the patients opted for ‘good’,

Analysis of aesthetic outcome

Aesthetic outcome was assessed by asking the patient how they felt about the appearance of operated site. Are they satisfied, uncomfortable, depressed or not able to do the normal activities. Most of the patients said they were satisfied with the aesthetic outcome. One of those after cross finger flap and one after SSG were uncomfortable.

Patient satisfaction was assessed by asking whether they are 'very satisfied', 'somewhat satisfied', 'neither satisfied nor dissatisfied', 'somewhat dissatisfied', 'very dissatisfied'. Patients were very satisfied with the aesthetic outcome except for few who said they were `somewhat satisfied'.

Nearly all the patients were satisfied with the functional and esthetic outcome.

OBJECTIVE ASSESSMENT :SENSATION

This static and moving 2PD was compared with the normal contra lateral hand.

- Two – point discrimination (2PD) testing was performed in 40 patients , as interpretable data could not be obtained from the five youngest patients in our study.
- The static 2PD in the flap ranged from 3 to 10 mm, with a mean of 6.8 ± 2.0 mm, compared to 3.0 ± 0.6 mm for the normal unaffected hand .

- The moving 2PD in the flaps ranged from 3 to 10 mm, with a mean of 5.5 ± 2.5 mm, compared to a mean of 3.8 ± 1.1 mm for the equivalent site on the normal contralateral hand .
- Higher 2 PD values were noted in older patients.

SUMMARY OF TWO- POINT DISCRIMINATION TESTING(n=40)

Table:8

	MEAN STATIC 2PD (mm)		**MEAN MOVING 2PD** (mm)	
	THENAR	CFF	THENAR	CFF
Flap side	**6.8+/- 2.5**	**7.1+/- 2.5**	**5.5+/- 2**	**7.8+/- 2**
Contralateral (normal)	**3.8+/- 1.1**		**3+/- 0.6**	

OBJECTIVE ASSESSMENT : MOVEMENTS

The active range of motion of the MP, PIP, and distal interphalangeal (DIP) joints of the reconstructed finger was measured. The active range of motion of the corresponding finger of the contralateral hand was measured as a control.

- Active and passive total range of motion (TRM) of the MP, PIP, and DIP joints of the reconstructed finger was measured with a standard hand goniometer and compared with normal contralateral finger

- Active TRM of the donor fingers averaged 156° (median 167.5, range 70–235).

- Average active TRM of the contralateral control fingers was 173.6° (median 175, range 95–270).

- There was a significant difference between the donor fingers and the control fingers (p=0.03) but

- there was no significant difference between the thenar and cross finger flap (p=0.91).

ACTIVE RANGE OF MOTION

Table:9

	THENAR	CFF	CONTROL
STUDY	156	154	173
MEAN	167.5	164	175
RANGE	70-235	62-230	95-270

There were no functionally significant digital flexion contractures or thumb adduction contractures observed at follow-up. The mean MP joint motion in the reconstructed finger was 96 ± 8.5°, compared to 102 ± 9.8° in the nonaffected side. This difference was not statistically significant ($p = 0.06$).

The mean PIP joint motion was 89 ± 3.6°, compared to 92 ± 5.0° for the contralateral side. Again,this difference did not reach statistical significance ($p = 0.09$).There was a statistically significant reduction in mean DIP joint motion observed in the affected digits (42° versus 55°) when compared to controls ($p < 0.01$) (Table 9).

The average calculated total active motion for the reconstructed digits was 215 ± 19°.

MEAN POSTOPERATIVE RANGE OF MOTION (n =45).

Table :10

	AFFECTED DIGIT	CONTALATERAL DIGIT	P (value)
Mean mp joint motion	96 ± 8.5	102 ± 9.8	0.06

(degrees ± SD)			
Mean PIP joint motion (degrees ± SD)	89 ± 3.6	92 ± 5.0	0.09
Mean DIP joint motion (degrees ± SD)	42 ± 10.8	55 ± 5.7	<0.01

Complications and secondary procedures done

Post operatively two of the patients developed marginal necrosis of flap, which was managed conservatively. One case of partial dehisence of wound was grafted secondarily, one case of complete loss of graft settled with dressings, 3 cases of wound infection were managed with antibiotics and dressings. Complete loss of thenar flap in one patient was managed with cross finger flap.

Sequelae

Numbness was the complaint in the post operative period in patients with SSG, thenar flap and cross finger flap. It improved with time.

Range of movement was mildly restricted in injured and donor finger in thenar flap group as well as in cross finger flap group, which improved with physiotherapy over time. Range of movements (ROM) was full after 3 months.

Pain in the fingertip was complained by 2 patients, 1 in thenar flap group and 1 in cross finger flap group which also settled over a period of 4 weeks.

Time from injury to reconstruction ranged from 2 to 48 h, with a mean of 12 h. Time to division ranged from 11 to15 days (mean 12.8 days). The reconstructive goals were met in all cases without revision.

DISCUSSION

It is pointless to argue whether an organ is more or less valuable than the other. However, this does not prevent us from saying that our hands make our daily lives easier if not possible. Hands are important all around but the fingertips and pulps are worth emphasizing. It has been said that"pulps are extensions to the brain" (1). This is true. Indeed, studying the cortex of the human brain shows that fingertips take up the largest space in cortical homunculus. Having some skills depends solely on having healthy fingertips. There are many examples to such skills, but being able to use cell phones and computer keyboards are among the first to remember, as they are important parts of our daily lives. When we use using these devices, mainly our pulps remain in contact with them especially for musicians who use string instruments. Fingertip injuries often cause pulp defects. A healthy pulp means a healthy fingertip. There are various methods to chose from when treating an injured fingertip, and On a different note, fingertip injuries are mostly treated

by young surgeons, especially by assistants on their shifts. As very well stated by Goldwyn, “The younger surgeons, the more emergency cases; the older surgeons, the more effective cases” (3). There is a verse in the Quran, the holy book of Muslims: “Yes, we are able to rebuild even their fingertips”

Fingertip injuries square measure very common and sophisticated that comprise the foremost common hand injuries. they're typically viewed as a comparatively minor injury. Their improper management will cause hefty loss of skillful hand operate. tip injury cause important morbidity poignant the activity in addition as social activities.

Management of finger tip injuries is complicated and not while not disputation as a spread of treatment choices square measure out there. there's consistent consciences within the management of finger tip injuries . Goals of treatment in finger tip injuries embrace preservation of helpful sensation, increasing practical length, preventing joint contractures, providing satisfactory look and avoiding donor disfigurement and practical loss.

The approach to the various variables together with age, sex, hand dominance, profession, hobbies, finger involvement, location, depth, angle of defect, nail bed injuries, standing of remaining soft tissue, co-morbid conditions and anatomy of tip defect.

As the primary goal of treatment of associate tip injury may be a painless tip with sturdy and animate skin, the information of the anatomy and out there techniques of treatment square measure of overriding importance

Fingertip injuries will be classified in line with the positioning of amputation and whether or not the involves the pulp or nailbed and seek advice from zone and plane of injury.

The injuries classified as zone I occur distal to the distal phalanx with preservation of majority of the nail bed and matrix. Treatment of zone I injuries square measure sometimes conservative.

Injuries classified as zone II square measure situated distal to the lunula of the nail bed and square measure characterised by exposure of the distal phalanx. These injuries need flap reconstruction. Plane of zone II will be additional classified as dorsal, transversal or area in line with the plane of amputation. The slope of transecion, and therefore the condition of the native tissue verify the simplest rehabilitative technique.

tip injuries classified as zone III involve the nail matrix and lead to entire loss of nail bed. Injuries in zone III don't seem to be thought of for elaborate reconstruction.

As finger tip injuries will be treated in several ways that, their management have to be compelled to be fastidiously personalized. If there's no

nominal tissue loss, the wound will be closed primarily with or while not surgery. Healing by secondary intention or open technique by combination of wound contraction and re-epithelialisation is applicable to tiny volarly directed tip wound with no exposure of bone. This approach has definite place for tip injuries in youngsters as they need a decent capability of regeneration.

When bone or sinew is exposed, at the bottom of tip wound the utilization of split skin attachment isn't possible and native flap is important. the kind of flap reconstruction that is suitable depends on extent of configuration of tip loss native flaps if properly applied will give a really satisfactory practical and esthetic result.

The various native flaps accustomed reconstruct tip embrace area v-y, bilateral v-y flaps, cross finger flap, thenar flaps and island flaps. Flap selection rely upon the orientation and configuration of the wound, lacerate digit and sex of the patient.

If the wound is little and involves a finger with a tranverse amputation on the far side the nailbed level and dorsal oblique amputation on the far side the proximal nail fold the area flap provides sensible results.

The thenar flap is good for finger tip injury with skin loss involving index and middle finger additional on the area facet and really well appropriate for

young females and youngsters. Thenar flap is best most well-liked in females because it doesn't scar the visible dorsum.

The cross finger flap is preferred if the wound is area directed while not sufficient area pulp to facilitate area flap. .However if native flap isn't possible, a regional flap like thenar, cross finger flap or neurovascular island flap might need to be thought of.

In case of relative contra indications like advanced age, degenerative arthritis, or different co-morbid conditions revision amputation is most well-liked.

The thenar flap was introduced by Gatewood [10, 13], a individually named however multiply proficient Chicago medico, in 1926. As originally formed, the flap was placed high on the thenar eminence and based mostly medially [10]. within the Fifties,

Flatt [8] powerfully supported a proximally based mostly thenar flap, however one that encroached considerably upon the palm. He cannily ended his article with the statement, “Badly done, the operation will cripple a hand.” several of the

criticisms leveled against thenar flaps have arisen from their rambling with region flaps, that square measure related to a high complication rate. The findings of this study support the caveats of flap style and division advanced by

Beasley [2, 3, 14], namely, that the flap ought to be placed high on the thenar eminence, based mostly laterally, and divided promptly.

All four fingers were affected, with twenty nine of forty five cases (64.4%) involving either the index or middle finger (Table 3). The finger was concerned in nine out forty five (20%) and at last very little was concerned in seven out of 45(15.5%). This study concludes that thenar flap is way appropriate for index and middle finger. the limited finger is also troublesome for thenar flap however a great deal ideal for a cross finger flap.

The mechanism of injury varied wide (Table 6), with industrial accidents being the foremost normally discovered mechanism in male patients, and interior doors the foremost common in youngsters. ladies were lacerate principally once concerned room and house hold activities particularly whereas victimization mixie.

Traumatic amputation of the tip produces a composite loss of tactile skin, pulp, and nail support. not like skin grafts or commonplace cross finger flaps, the thenar flap will give a three-dimensional composite reconstruction that's practical, sensible, and esthetically acceptable. this is often mirrored within the form results, with ninety fifth of respondents reportage sensible or wonderful ends up in all 3 classes (Table 7).

 In our study series thirty six patients completed the form. In relevancy sensibility, seventy fifth of the patients rated their result pretty much as good or wonderful, and therefore the mean response on the 7-point scale was five.9. In relevancy operate, ninety two of the patients characterised their result pretty much as good or wonderful, and therefore the mean rating was vi.6 out of 7. 100% of the patients rated the looks of the reconstructed finger pretty much as good or wonderful, and therefore the mean rating was vi.9 out {of seven|of seven} (Table 7).

 2 patients according cold intolerance. One patient according painful hyperesthesia within the tip. there have been no tender or hypertrophic donor website scars according.

In a similar study by Brian Rinker Twelve patients completed the form. In relevancy sensibility, nine of twelve patients rated their result pretty much as good or wonderful, and therefore the mean response on the 7-point scale was four.9. In relevancy operate, eleven of twelve patients characterised their result pretty much as good or wonderful, and therefore the mean rating was vi.1 out of 7. Twelve of twelve patients rated the looks of the reconstructed finger pretty much as good or wonderful, and therefore the mean rating was vi.3 out of 7.

Objective practical information following thenar flaps don't seem to be luxuriant within the literature. In 1983, Dellon [6] according wonderful sensory recovery during a series of 5 distally based mostly thenar flaps. The mean static 2PD was five.6 mm, and therefore the moving 2PD was three.3 millimetre at a mean follow-up of three2 months. The flaps were raised well onto the palm and divided no previous three weeks. Objective vary of motion information weren't according. In 1996, Barbato et al. according a series of twenty patients UN agency underwent a distally based mostly thenar flap. Again, wonderful sensory recovery was according, with a mean static 2PD of vi.5 millimetre at twenty one months_ follow-up. the target vary of motion wasn't according, however there was a twenty fifth rate of PIP flexion muscle contraction requiring extension splinting.

In our study the static 2PD within the flaps ranged from three to ten millimetre, with a mean of five.5 ± 2.5 mm, compared to a mean of three.8 ± 1.1 millimetre for the equivalent website on the conventional contralateral hand .

The moving 2PD within the flap ranged from three to ten millimetre, with a mean of vi.8 ± 2.0 mm, compared to three.0 ± 0.6 millimetre for the conventional unaffected hand .

In the gift study cluster there have been no important flexion contractures discovered. There was atiny low measurable reduction in mean MP and PIP

joint motion within the reconstructed digits in comparison to the conventional contralateral facet (Table 5). The distinction was 3° for the PIP joint and 6° for the MP joint, and these values might have reached applied mathematics significance had the sample size been larger. There was a measured decrease in DIP joint motion of 13° compared to the contralateral facet, and this distinction was statistically important. it's unclear, however, if these variations in motion were caused by the reconstruction or the initial injury, particularly within the case of the DIP joint, as many patients had amputations through the proximal third of the distal phalanx. Motion was equally well preserved for ulnar-sided digits as for the index and long fingers. within the occasional patient with a really wide hand and short digits, the tiny finger doesn't well reach the thenar eminence, however within the absence of this configuration, associate ulnar-sided defect shouldn't be thought of a reason for a thenar flap. There was no distinction in motion discovered between patients older than thirty years (N = 5) and younger patients and age wasn't thought of a reason for thenar flap throughout the study amount. However, the tiny range of patients within the >30 years people, a mirrored image of the demographics of the hand trauma patients at our establishment, severely limits our ability to draw important conclusions concerning the impact of the thenar flap upon vary of motion within the older population.

The sensory recovery was incomplete all told cases, however protecting sensibility was regained all told however 3 patients,as proven by threshold testing . in line with the observations of different authors, sensory recovery was higher within the younger patients. The mean static 2PD within the flaps was vi.8 mm, and therefore the mean moving 2PD was five.5 mm. These results compare favourably with revealed values for noninnervated cross-finger flaps [5, 15, 17, 18] (Table 7),and fall inside the vary of revealed values for reverse digital artery flaps [9, 11, 19, 20] (Table 8).

Our study was compared with varied international commonplace studies and states that the static 2PD and moving 2PD of thenar was much better than cross finger flap. In different studies solely either moving or static 2PD was out there in most of them.

COMPARISON OF THENAR FLAP SENSORY RECOVERY WITH HISTORICAL VALUES FOR CROSS- FINGER FLAPS

Table :11

S.NO	STUDY	N	MEAN M2PD(mm)	MEAN S2PD(mm)
1	Present study THENAR	19	5.5	6.8
2	Present study CFF	26	7.1	7.8
3	Smith and Bom	17	N/A	6.9

4	Thomson and Sorokolit	22	N/A	7.8
5	Cohen and Cronin	6	9	N/A
6	Nishibawa and Smith	15	7.86	9.73

COMPARISON OF THENAR FLAP SENSORY RECOVERY WITH HISTORICAL VALUES FOR REVERSE DIGITAL ARTERY FLAPS

Table :12

S.NO	STUDY	N	MEAN M2PD(mm)	MEAN S2PD(mm)
1	Present study THENAR	19	5.5	6.8
2	Present study CFF	26	7.1	7.8
3	Foucher et,al	37	N/A	5.6
4	Lai et al	12	N/A	6.8
5	Yildirim et al	23	N/A	6.0-8.8
6	Varitimidis et al	63	N/A	4

The thenar flap is a good and reliable means that of composite tip reconstruction. The results of this study don't support the rivalry that thenar flaps square measure related to problematic donor scars or operative flexion contractures, even within the male adults and arm bone digits. Donor scar within thenar behaves as a brand new crease in the palm.where because the donor scar is within the adjacent finger and it the grafted space that behaves otherwise and not considerable.

The common complication encountered post operatively were marginal gangrene, cold intolerance and hypersensitivity. Marginal gangrene was because of tension closure and different minor complication like wound organic phenomenon, partial graft loss were freelance of the surgical technique used to them. cold intolerance and hypersensitivity square measure essentially complications of injury and not the treatment. One patient according neuromatous-type hypersensitivity at the tip.

There were no painful or hypertrophic donor website scars discovered within the series. practical ends up in this series compare favourably to different rehabilitative choices. once sound principles of flap style, temporal order of division, and early and immediate mobilization of each donor finger and thumb square measure followed, wonderful outcomes will be expected.

CONCLUSION

- An excellent tissue match of color, texture, bulk and contour of the lost finger pulp was provided by thenar flap.
- Aesthetic appearance of the finger tip following thenar flap is superior to cross finger flap.
- The sensory recovery of the finger tip in thenar flap group is comparably better than with Cross finger flap.
- Tactile discrimination and tactile localisation is always better and appreciable
- The donor site is inconspicuous for the thenar flap.
- Provides fingerprints to the new fingertip
- Thenar flap was found to be better option than cross finger flap as per subjective and objective interpretation.
- Thenar flap is a better option for radial fingers, young thin female individuals. Thenar flap is best preferred for females as it does not produce any scar in the dorsum of the hand
- Thenar flap gives the advantage that skin graft is not required for closure of donor site

- Thenar flap gives a stable, sensate ,robust and glabourous skin to the injured finger tip.
- Adjacent finger is no way injured in thenar flap compared to cross finger flap so can be suitable for even adjacent injured fingers
- **Excellent results and outcome with out complications can be achieved by sound principles like**

1. **Proper flap design,**
2. **Timing of flap division,**
3. **Good rehabilitation by early mobilisation.**

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PROFORMA

NAME : **P.S.NO:**

AGE/SEX : **I.P.NO:**

ADDRESS : **D.O.INJURY:**

OCCUPATION: **D.O.SURGERY:**

SIDE: RIGHT/LEFT **D.O.DIVISION:**

PRESENTING COMPLAINTS: **HANDEDNESS:**

TYPE OF INJURY : CRUSH/ SLICING/AVULSION/AMPUTATION

MODE OF INJURY:INDUSTRIAL/ASSAULT/RTA/DOOR /HOME

DAYS OF DIVISION:

PAIN :

ASSOCIATED INJURIES:

MEDICAL HISTORY: HT / DM / BA / PTB / IHD

PERSONAL HISTORY: SMOKING / ALCOHOL

TREATMENT HISTORY:

GENERAL PHYSICAL EXAMINATION

CONSCIOUSNESS

BUILD/ NUTRITION

VITALS

PALLOR

EXAMINATION OF HAND

DIGIT/ DIGITS INVOLVED

SIZE OF DEFECT:

LEVEL OF INJURY:

BONY EXPOSURE:

STATUS OF FLEXOR / EXTENSOR TENDON

ASSOCIATED NAIL BED INJURY

X-RAY OF HAND: 2 views

DIAGNOSIS:

SURGICAL PROCEDURE:

ANAESTHESIA:

AVERAGE DURATION OF THE PROCEDURE THENAR FLAP/CFF:

POST OPERATIVE PERIOD

SURGICAL COMPLICATIONS

PHYSIOTHERAPY

ANY SECONDARY PROCEDURES

MEASUREMRNTS:

TWO POINT DISCRIMINATION MOVING & STATIC

RANGE OF MOTION OF DIP,PIP,MP JOINT

FOLLOW UP:

SENSORY EXAMINATION:

SEQUELAE

DEFORMITY

STIFFNESS

TENDERNESS

COLD INTOLERANCE

SENSORY PROBLEMS

NAIL DEFORMITY

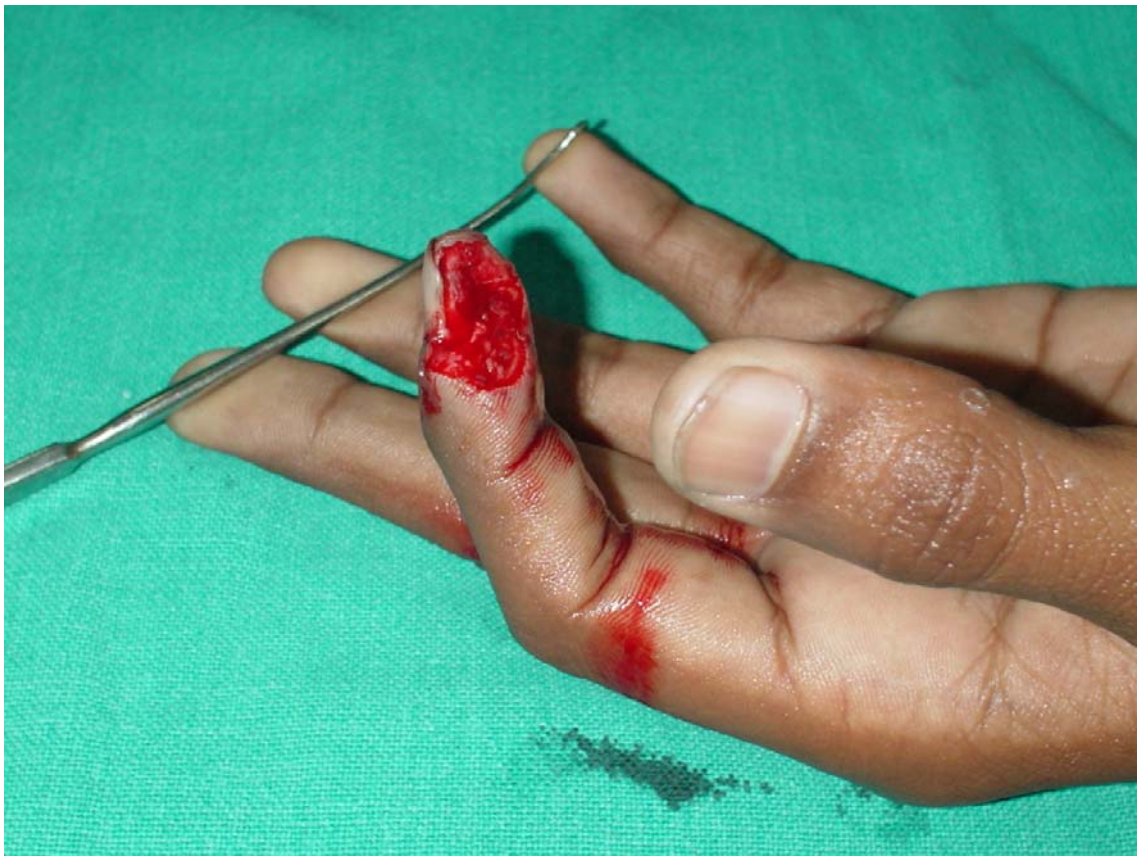
LEGENDS AND ABBREVATIONS

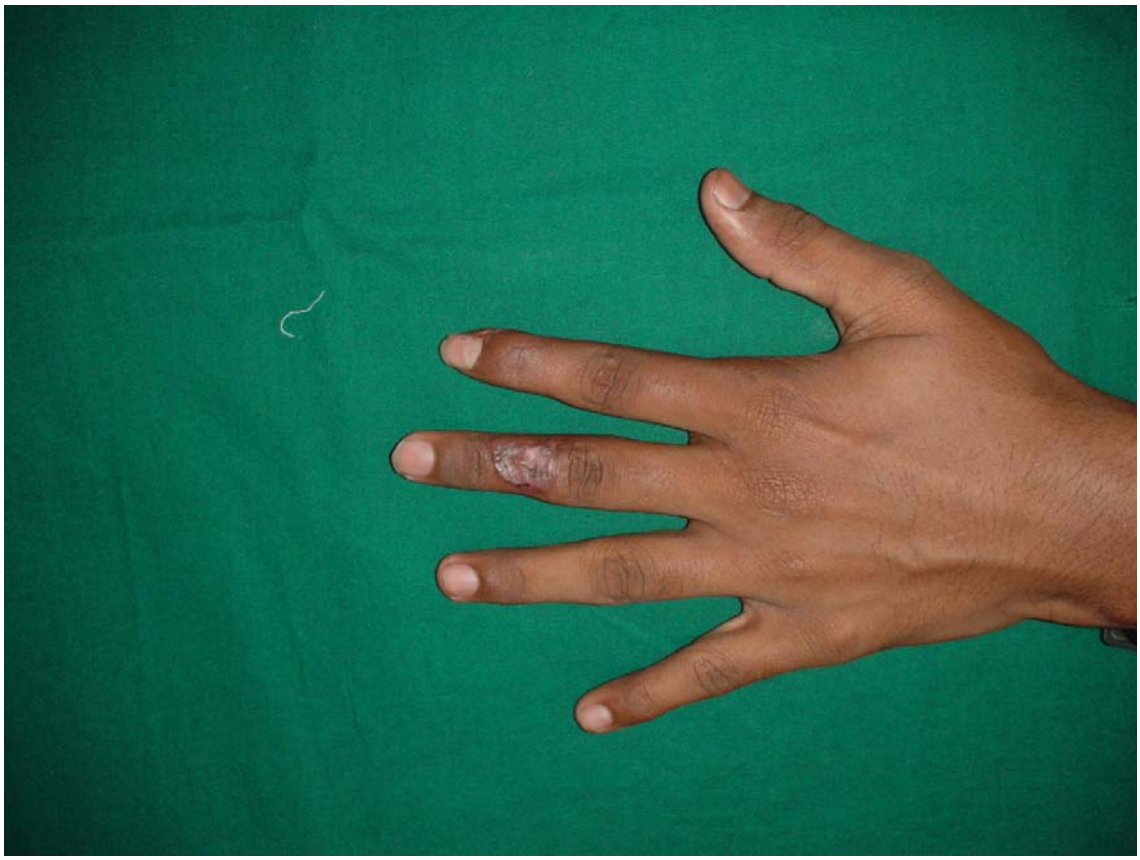
RTA	ROAD TRAFFIC ACCIDENT
CFF	CROSS FINGER FLAP
SSG	SPLIT SKIN GRAFT
TPX	TERMINAL PHALANX
MPX	MIDDLE PHALANX
DIP	DISTAL INTERPHALANGEAL JOINT
PIP	PROXIMAL INTERPHALANGEAL JOINT
MP	METACARPOPHALANGEAL JOINT
S2PD	STATIC TWO POINT DISCRIMINATION TEST
M2PD	MOVING TWO POINT DISCRIMINATION TEST
VS	VERY SATISFIED

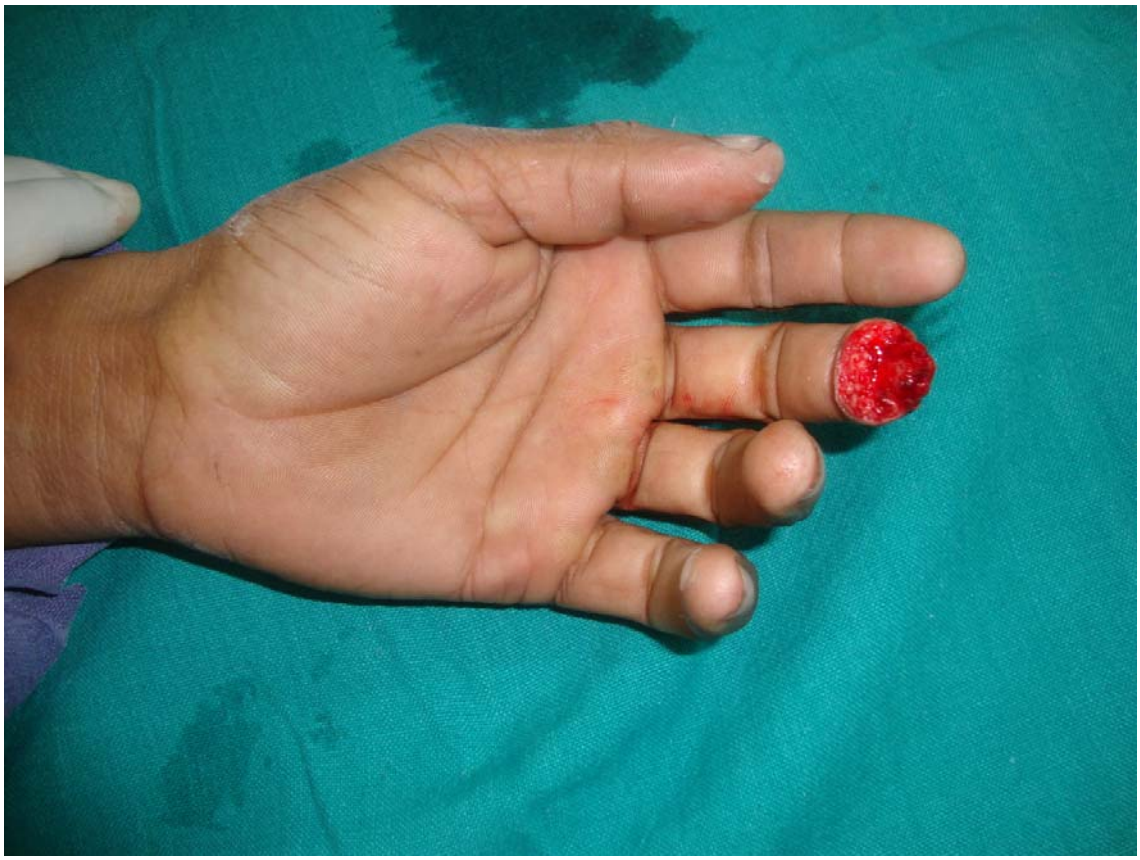
PHOTO I

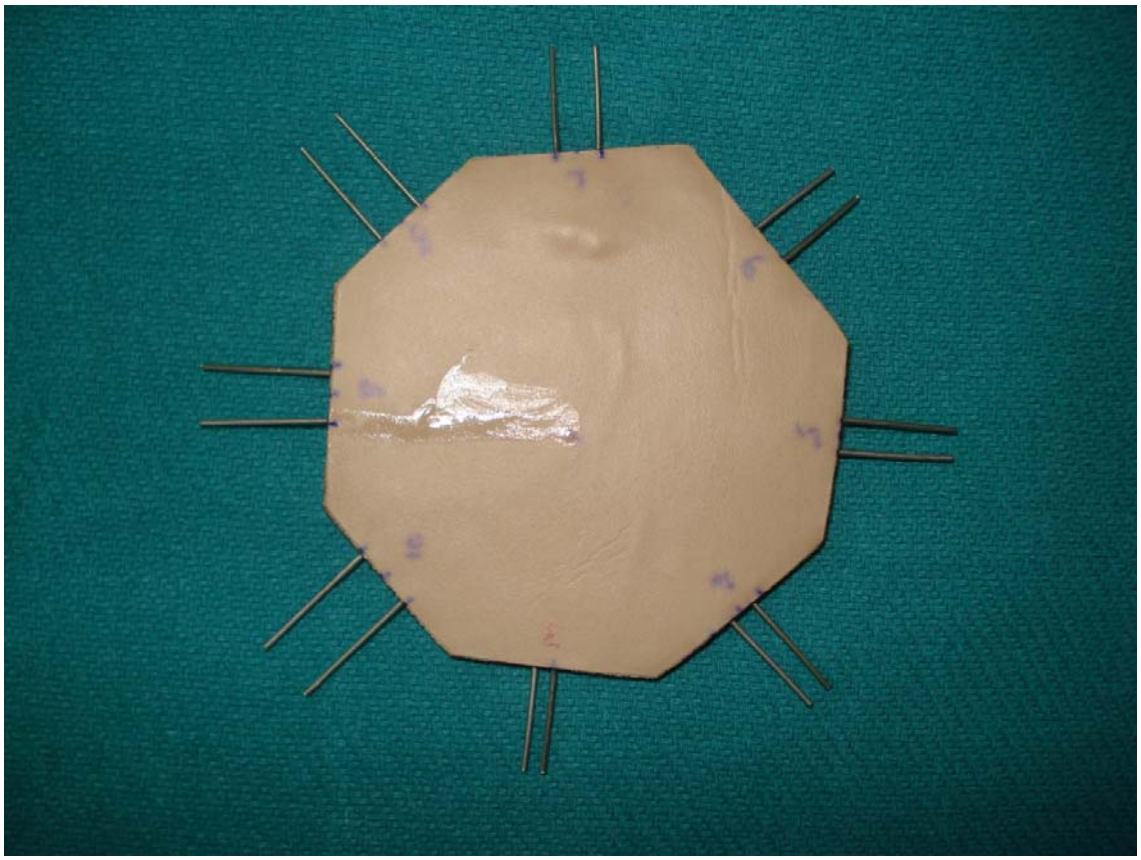
THENAR FLAP FOR INDEX FINGER

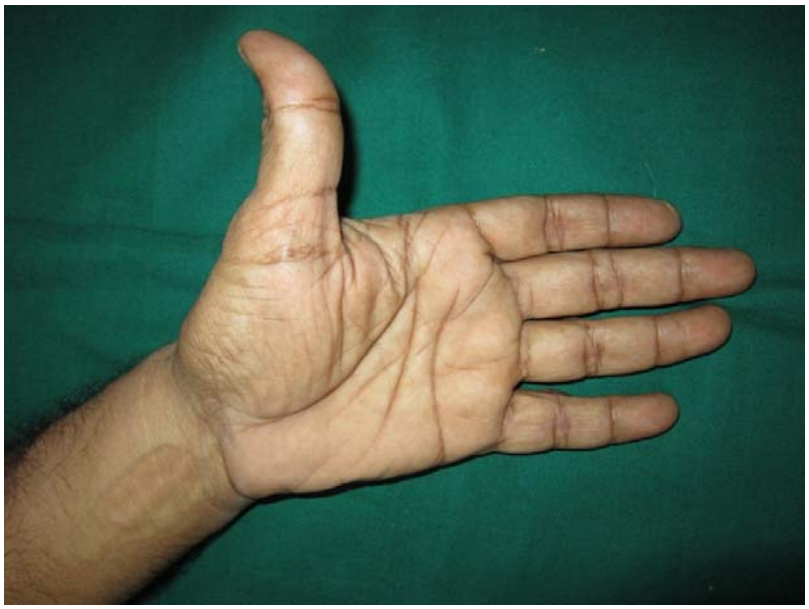
THENAR FLAP
DIVISION AND
INSET

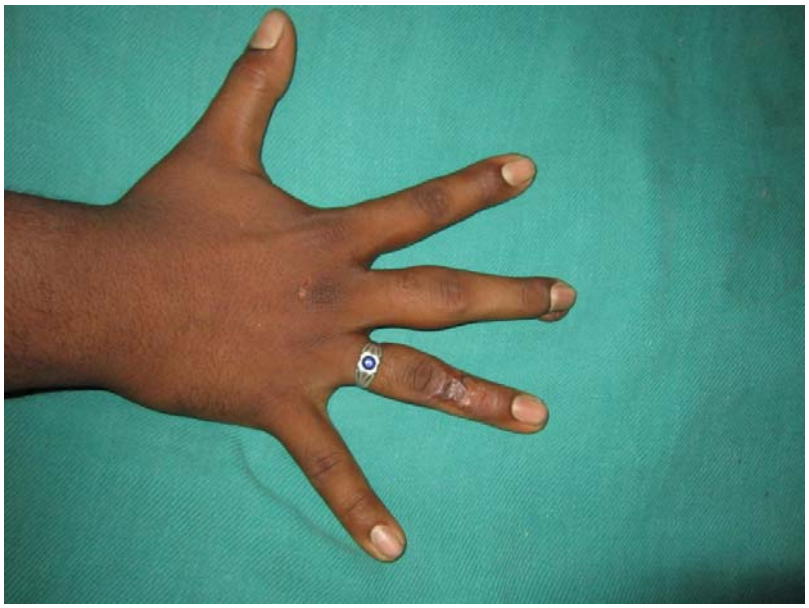


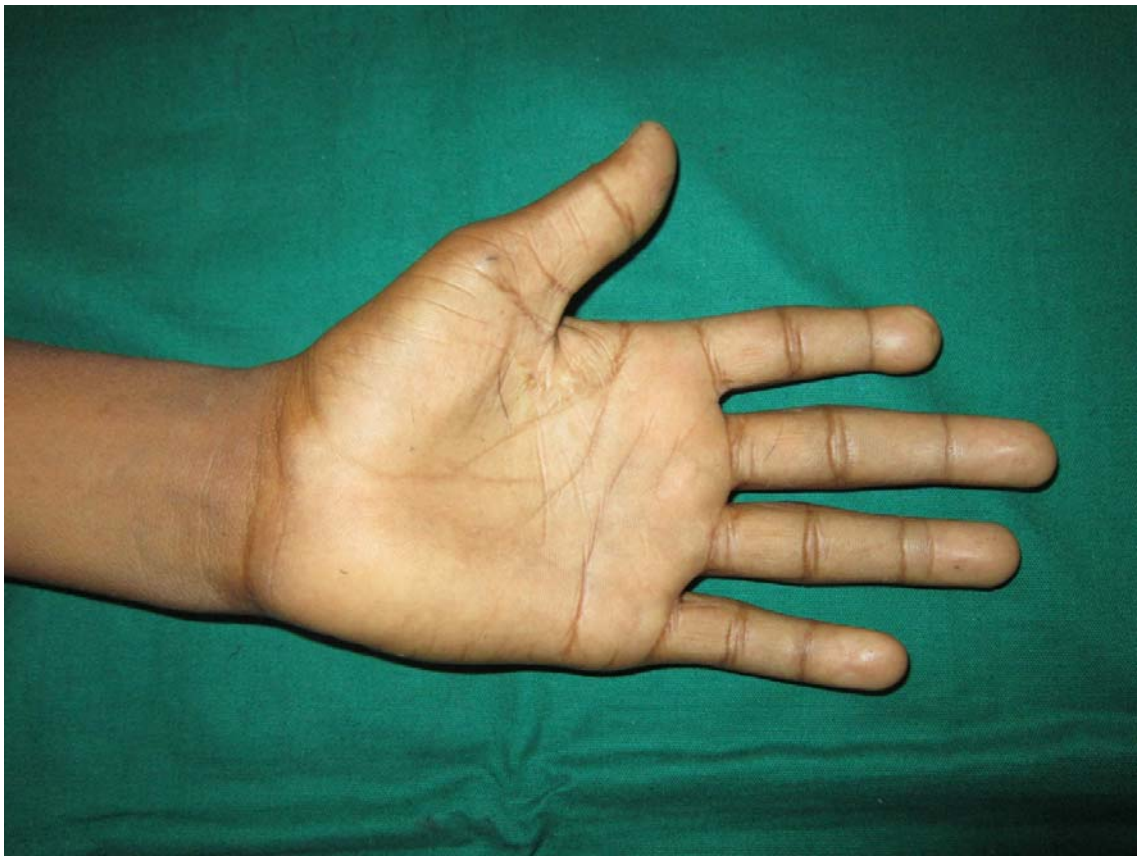


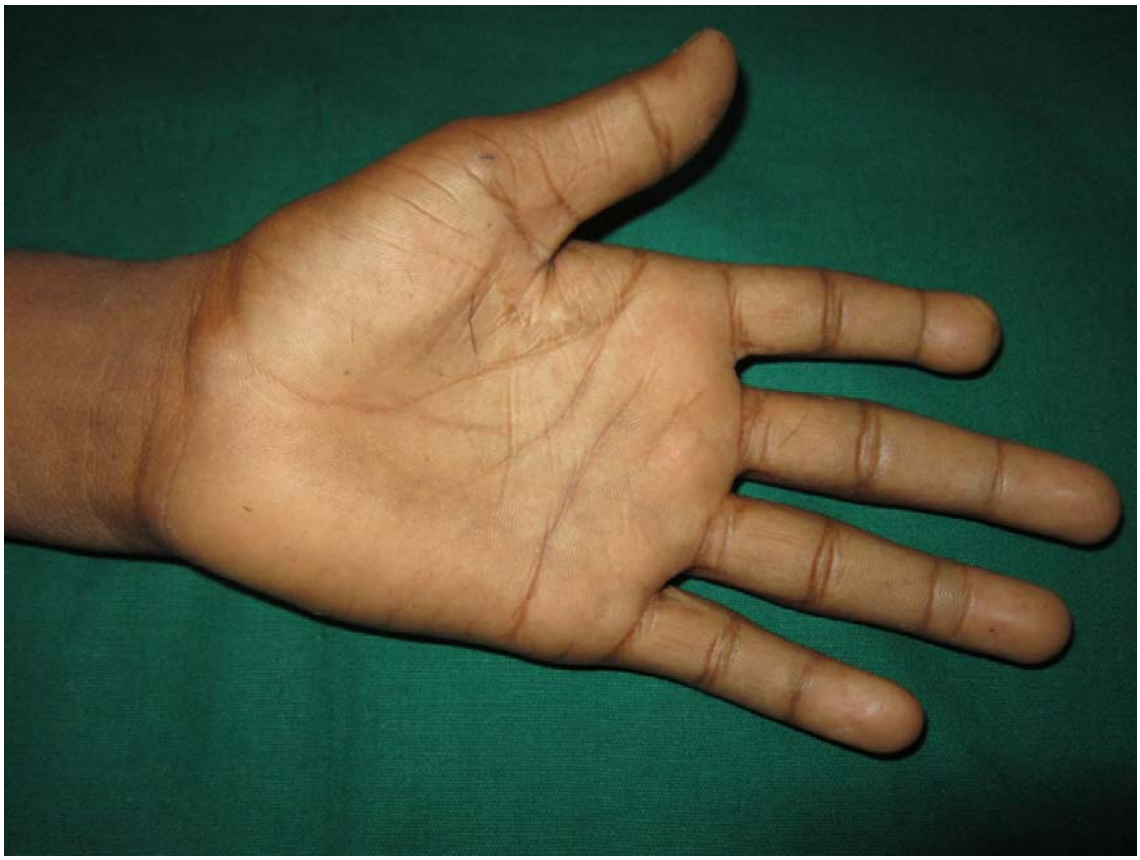


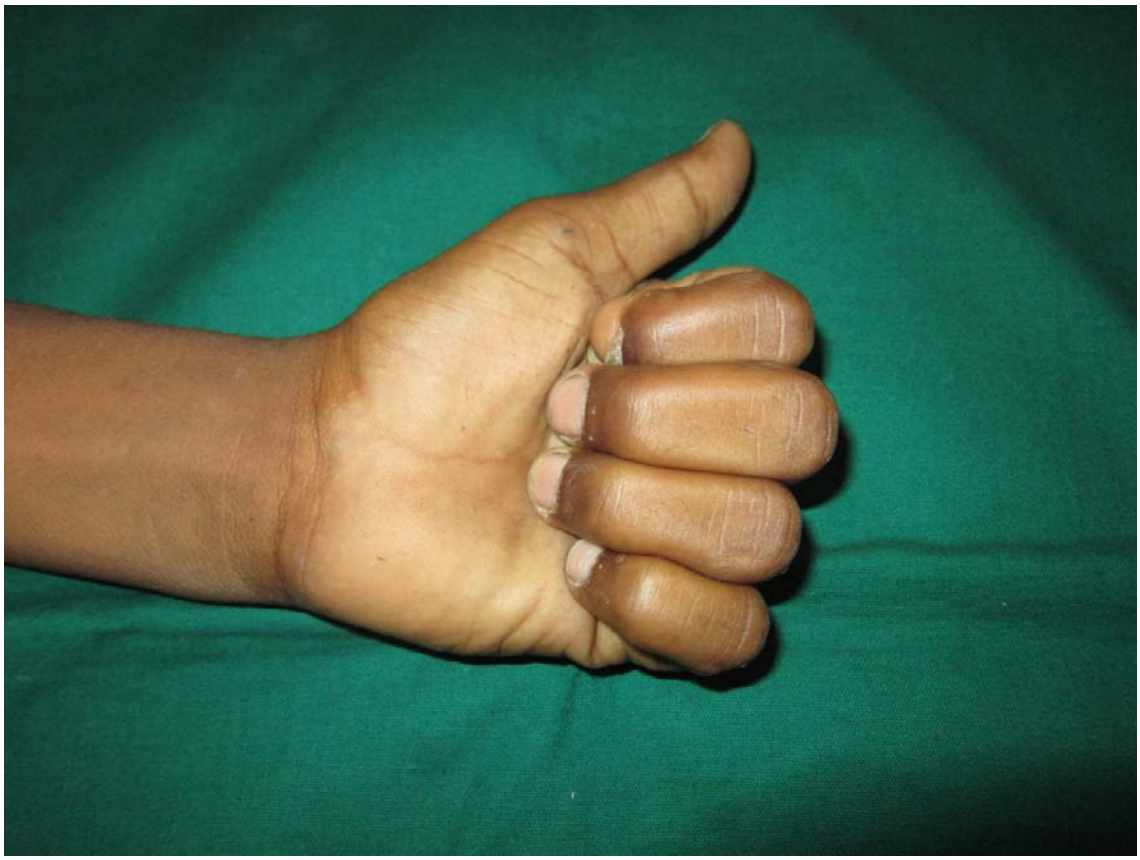


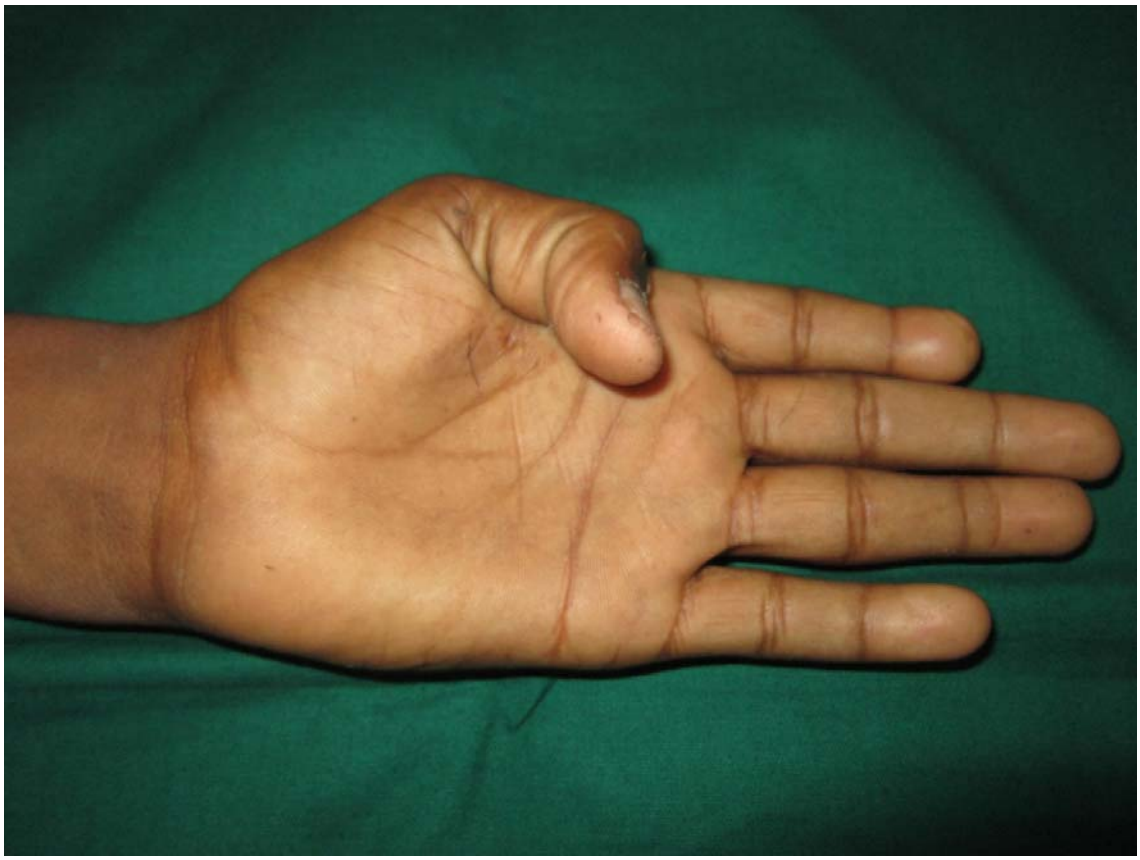












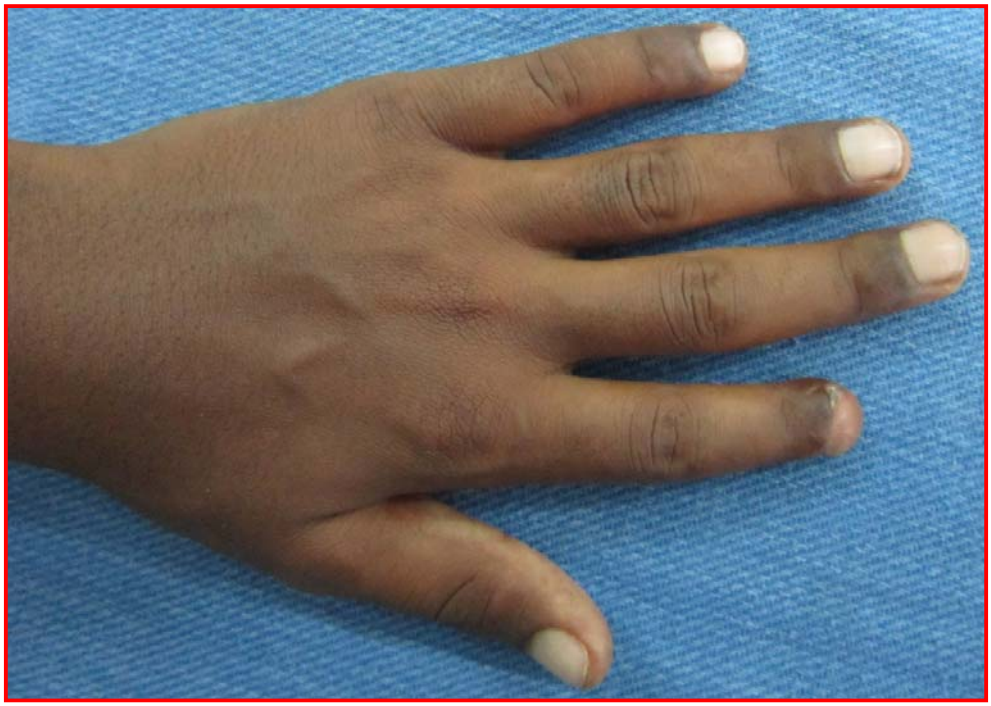
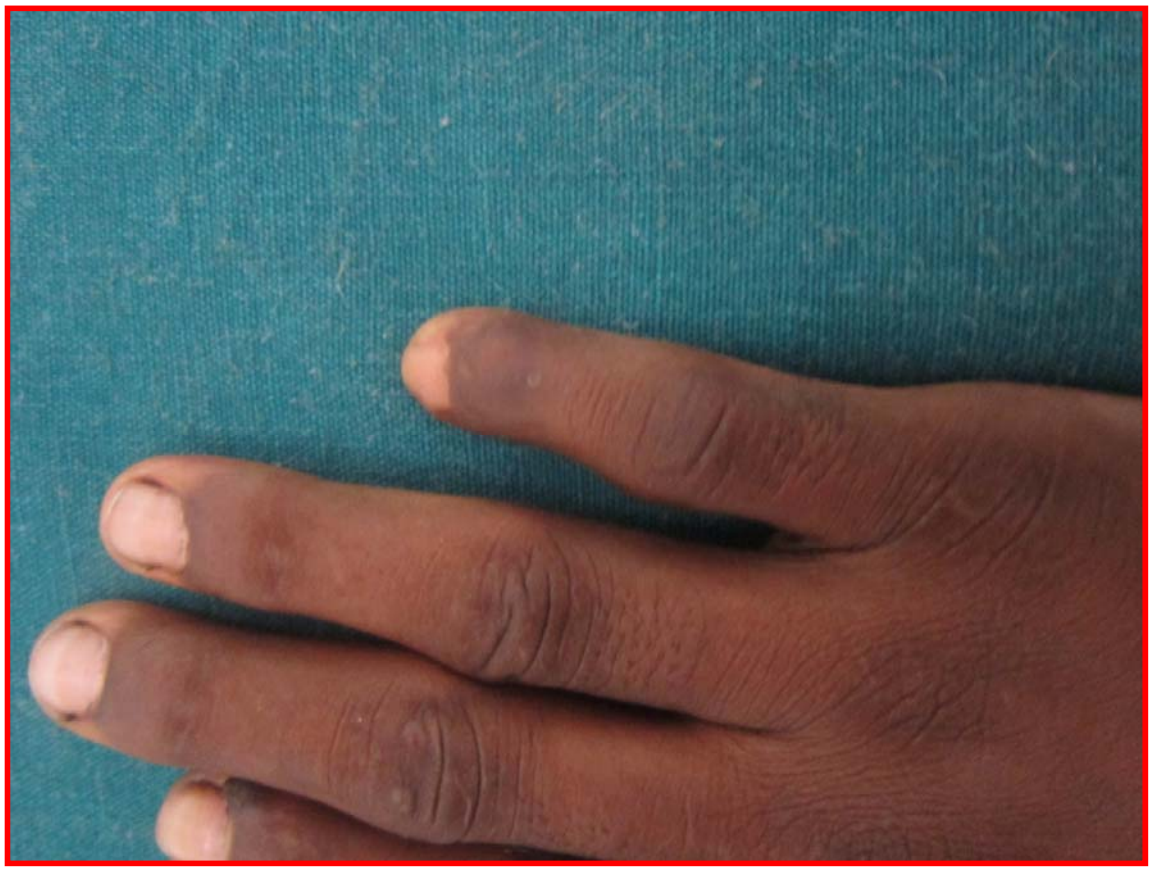


PHOTO IV

THENAR FLAP FOR LITTLE FINGER



POST OPERATIVE 6 MONTHS FOLLOW UP

THENAR FLAP MARKING

FLAP INSET

Photo III

THENAR FLAP FOR RING FINGER

FLAP DIVISION AND INSET

i

Photo II

THENAR FLAP FOR MID FINGER

DISADVANTAGES OF CFF

TEXTURE

COLOUR MATCH

CONTOUR

CROSS FINGER FLAP GROU

S.NO	NAME	AGE/SEX	PS NO	SIDE	FINGER	TYPE OF INJUR	MODE	COMPLICATION	SEC PRO	SEQUELAE	FUNCTION	AESTHETICS
1	SURIYA	13/M	323418	RIGHT	MIDDLE	CRUSH	INDUST	-	-	-	GOOD	VS
2	MOHAN	42/M	324221	LEFT	INDEX	AVULSION	INDUST	WOUND INF	CONSER	STIFFNESS	GOOD	VS
3	RAJU	32/M	334127	RIGHT	RING	CRUSH	ASSAULT	-	-	-	GOOD	VS
4	PAVITHRA	24/F	323785	RIGHT	INDEX	SLICING	HOME	-	-	NUMBNESS	FAIR	VS
5	MANI	27/M	324122	RIGHT	LITTLE	CRUSH	INDUST	-	-	-	GOOD	S
6	LATHA	18/F	323961	RIGHT	MIDDLE	SLICING	HOME	-	-	-	GOOD	VS
7	BALA	23/F	323501	RIGHT	MIDDLE	AMPUTATION	INDUST	DEHISCENCE	SEC SUTURING	-	GOOD	VS
8	KAVITHA	8/FC	323631	LEFT	LITTLE	AVULSION	DOOR	-	-	-	GOOD	VS
9	MARY	19/F	324611	RIGHT	INDEX	CRUSH	HOME	-	-	-	GOOD	VS
10	PICHIAH	40/M	327853	LEFT	LITTLE	AMPUTATION	INDUST	WOUND INF	CONSER	-	FAIR	VS
11	RAJANGAM	26/M	324166	LEFT	MIDDLE	AVULSION	INDUST	PARTIAL LOSS	SSG	-	GOOD	VS
12	BANUMATHI	22/F	338196	RIGHT	RING	SLICING	HOME	-	-	-	GOOD	VS
13	AROKIADOSS	39/M	324912	RIGHT	LITTLE	AVULSION	INDUST	-	-	-	GOOD	VS
14	MANOHARAN	30/M	334127	RIGHT	RING	AVULSION	INDUST	DEHISCENCE	CONSER	-	GOOD	VS
15	MUJITHA BEGAM	24/F	323517	RIGHT	INDEX	CRUSH	HOME	-	-	-	GOOD	VS
16	KUMARI	32/F	324561	LEFT	INDEX	CRUSH	HOME	MARGINAL NECR	CONSER	-	GOOD	VS
17	ARTHY RANI	7/FC	327611	RIGHT	MIDDLE	CRUSH	DOOR	-	-	-	GOOD	VS
18	JOHNSON	9/MC	321249	RIGHT	LITTLE	CRUSH	DOOR	-	-	-	GOOD	VS
19	KRISHNA	19/M	334138	LEFT	RING	AMPUTATION	INDUST	-	-	-	GOOD	VS
20	SARVESH	14/M	324697	RIGHT	MIDDLE	SLICING	INDUST	-	-	-	GOOD	VS
21	VIJAY	18/M	337242	RIGHT	INDEX	SLICING	RTA	-	-	-	GOOD	VS

22	RAVI	28/M	323561	RIGHT	MIDDLE	AVULSION	INDUST	-	-	-	GOOD	S
23	MUTAHIAH	34/M	331167	RIGHT	RING	CRUSH	INDUST	TOTAL LOSS	SSG	NUMBNESS	GOOD	VS
24	NITHYA	9/FC	321598	RIGHT	RING	CRUSH	DOOR	-	-	-	GOOD	VS
25	ASHISH	6/MC	329087	RIGHT	INDEX	CRUSH	DOOR	-	-	-	GOOD	VS
26	MOORTHY	29/M	324781	RIGHT	INDEX	CRUSH	INDUST	-	-	-	GOOD	VS

UP

DAYS DIV	FOLLOW UP	MP	PIP	DIP	FLAPS2PD	NORMALS2PD	FLAPM2PD	NORMALM2PD
14	9 MONTHS	95	90	45	7	4	7	5
15	1.2 YEARS	95	90	30	8	4	8	4.5
14	6MONTHS	85	95	25	10	5	5.5	5
16	8 MONTHS	85	90	30	9	3	7	5
14	2 YEARS	95	85	45	7	5	6	5
13	11 MONTHS	100	80	40	8	4	8	4
15	10 MONTHS	80	75	40	8	5	8	5
14	1.5 MONTHS	100	80	35	7	4	6	4
14	6 MONTHS	95	85	40	7	3	7	5
14	1.6 YEARS	-	-	-	-	-	-	-
15	9 MONTHS	100	85	40	6	4	7	5
14	6 MONTHS	100	75	45	7	4	10	4
14	11 MONTHS	105	80	40	8	4	7	4.5
14	1.3 YEARS	75	75	40	7	5	8	-
14	7 MONTHS	105	80	40	7	4	7	4
14	10 MONTHS	100	80	40	8	4	8	5
15	8 MONTHS	-	-	-	-	-	-	-
14	1 YEAR	95	80	45	7	4	9	5
17	1.3 YEARS	100	90	35	8	4	6	5.5
14	4 MONTHS	95	95	40	7	4	6	4
14	9 MONTHS	95	90	40	8	5	6	5

14	1.2 YEARS	100	80	30	7	4	7	4.5
14	2 YEARS	95	85	40	7	4	6	4
15	1.8 YEARS	95	75	40	8	5	6.5	5
14	1 YEAR	-	-	-	-	-	-	-
16	8 MONTHS	95	90	45	7	4	7	5

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INTRODUCTION

Whenever we face an illness, the aching part of our body reminds and warns us. A healthy person would not really remember and feel his back, unlike a person with a herniated disk pain in the area, can barely stand up. With this approach, we realize that every organ in our body is valuable and important; trying to prove one is above the others would be absurd. Having said that,we could think of hands as of those organs that distinguish humans from other living beings. As we all know mobility is watch word for upper limb, hands are important for daily living for all human. No machine or Robot in the world can replace a sensate and mobile hand and fingers. The hand is second only to face in its representation in the somatic sensory cortex of the brain [1] Together with the muscles of vocalization, the hand accounts for more than half of the entire primary motor cortex [2] .

Hands are important with all their vessels, nerves, tendons, joints, skin and subcutaneous fatty tissues. For co-ordinated interaction of our hands and fingers with each other, the most important movement is opposition. Healthy pulp are very important not only for the transaction of fingers with each other, but also for the transaction with objects all around us. Finger tip is very useful for fine prop receptive touch and tactile sensations. All finger tip injuries represent tip of the iceberg.Thus, when there is a fingertip injury, it is mostly